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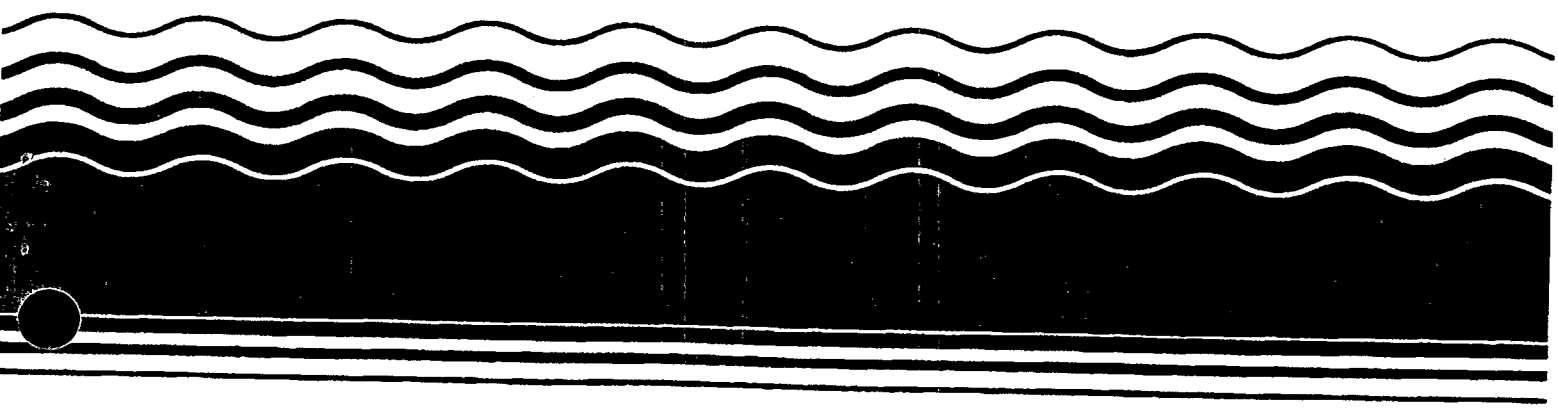
EPA Superfund
Record of Decision:

USA Vint Hill Farms Station
AREEs 2, 4, 28-5, & 31
Warrenton, VA
7/1/1999



FINAL
DECISION DOCUMENT
AREEs 2, 4, 28-5, AND 31
VINT HILL FARMS STATION
WARRENTON, VIRGINIA

Prepared for:
U.S. Army Communications-Electronics Command

Prepared by:
IT Corporation
Edgewood, Maryland

June 1999

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ABBREVIATIONS AND ACRONYMS

ARAR	applicable or relevant and appropriate requirement
AREE	Area Requiring Environmental Evaluation
bgs	below ground surface
BRA	Baseline Risk Assessment
BRAC	Base Realignment and Closure
CECOM	Communications-Electronics Command
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERFA	Community Environmental Response Facilitation Act
CFR	Code of Federal Regulations
DD	Decision Document
EEQ	environmental effects quotient
ENPA	Enhanced Preliminary Assessment
ERA	Ecological Risk Assessment
ERC	Environmental Restoration Company
FS	Feasibility Study
ft	feet
HHRA	Human Health Risk Assessment
HI	Hazard Index
HQ	Hazard Quotient
ICF KE	ICF Kaiser Engineers, Inc.
IEUBK	Integrated Exposure Uptake Biokinetic
MSL	mean sea level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
PAH	polynuclear aromatic hydrocarbon
ppm	parts per million
RBC	risk-based concentration
RI	Remedial Investigation
SAIC	Science Applications International Corporation
SARA	Superfund Amendments and Reauthorization Act
SI	Site Inspection
STP	sewage treatment plant
TPH	total petroleum hydrocarbon
TRV	toxicity reference value
USACE	U.S. Army Corps of Engineers
USAEC	U.S. Army Environmental Center
USEPA	U.S. Environmental Protection Agency
UST	underground storage tank
VAC	Virginia Administrative Code
VDEQ	Virginia Department of Environmental Quality
VHFS	Vint Hill Farms Station
VPDES	Virginia Pollutant Discharge Elimination System

DECLARATION FOR THE DECISION DOCUMENT
REMEDIAL ALTERNATIVE SELECTION

Site Name and Location

Areas Requiring Environmental Evaluation (AREEs) 2, 4, 28-5, and 31
Vint Hill Farms Station
Warrenton, Virginia

Statement of Basis and Purpose

This Decision Document (DD) presents the selected remedial action for soil at AREEs 2, 4, 28-5, and 31 at Vint Hill Farms Station (VHFS), Warrenton, Virginia, chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986 and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 C.F.R. Part 300. This document was prepared as a joint effort between the U.S. Army, the Virginia Department of Environmental Quality (VDEQ), and the U.S. Environmental Protection Agency (USEPA). The remedial action decision is based on documents contained in the Information Repository.

Assessment of the AREEs

Actual or threatened releases of hazardous substances from AREEs 2, 4, 28-5, and 31, if not addressed by implementing the remedial action selected in this DD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

Description of the Selected Remedy

This action addresses the principal threat at AREEs 2, 4, 28-5, and 31 by the excavation of contaminated soil and off-site disposal at a permitted facility.

Statutory Determinations

The selected remedy is protective of human health and the environment, complies with Federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable for AREEs 2, 4, 28-5, and 31. However, because treatment of the principal threat at AREEs 2, 4, 28-5, and 31 was not found to be practicable, this remedy does not satisfy the statutory preference for treatment as a principal element of the remedy. A five-year review will not be necessary for AREEs 2, 4, 28-5, and 31 since the selected remedy involves the removal of contaminated soil to risk-based cleanup levels.

Robert L. Nabors

ROBERT L. NABORS
Major General, USA
Commanding
U.S. Army Communications-Electronics Command

7/1/99
Date

DECISION SUMMARY

1.0 INTRODUCTION

The remedial action decision is based on the Phase II Reuse Area Remedial Investigation (RI) Report (USACE, 1999) which includes a Baseline Risk Assessment (BRA) documenting the risks from contamination in the soils at Areas Requiring Environmental Evaluation (AREEs) 2, 4, 28-5, and 31. In the BRA, it was determined that the soils at AREEs 2, 4, and 31 pose unacceptable risks to human health and the environment. In addition, total petroleum hydrocarbon (TPH) concentrations in soil at AREE 28-5 exceed the Virginia TPH soil action level for underground storage tanks (USTs). Therefore, the soils at AREEs 2, 4, 28-5, and 31 require remedial action to be protective of human health and the environment.

A feasibility study (FS), which develops and examines remedial action alternatives for a site, was performed for AREEs 2, 4, 28-5, and 31 and presented in the Proposed Plan (see Attachment 1).

2.0 SITE BACKGROUND

Vint Hill Farms Station (VHFS) is part of the U.S. Army Communications - Electronics Command (CECOM) and, while active, primarily functioned as an Army installation engaged in communications intelligence. VHFS is located approximately 40 miles southwest of Washington, D.C., in Fauquier County, Virginia, as shown on Figure 1. The installation occupies approximately 701 acres of land near the town of Warrenton, Virginia. Approximately 150 acres of the installation are improved grounds in the southern portion of the property used for industrial operations, administration buildings, and residential housing. Approximately 94 acres in the eastern portion of the property are mature hardwood forest, and the majority of the remaining 457 unimproved and semi-improved acres in the northern portion of the property are used for stationary and mobile antenna operation sites.

VHFS was designated for closure in March, 1993, under the Base Realignment and Closure (BRAC) Act. Pursuant to the decision to close the installation, an Enhanced Preliminary Assessment (ENPA) and a Community Environmental Response Facilitation Act (CERFA) investigation of VHFS were conducted by Science Applications International Corporation (SAIC) to assess the environmental condition of the installation. The ENPA and CERFA investigations were completed in April and May, 1994, respectively. The ENPA identified 42 AREEs from the review of installation records, aerial photographs, installation personnel interviews, federal and state regulatory records, and visual inspection. Of these 42 AREEs, 27 were recommended for further investigation.

These 27 AREEs were investigated from September, 1994, to June, 1995, as part of the Site Inspection (SI) conducted by SAIC. The objective of the SI was to determine the presence or absence of contamination and the chemical nature of any detected contamination. The final SI Report (USAEC, 1996), which was completed in June, 1996, identified 24 AREEs which required further investigation. In addition, four new AREEs were identified during site reconnaissance to warrant further investigation subsequent to the SI. AREEs that were determined to warrant further investigation and are located in the Phase II reuse area (shown on Figure 2) were investigated between February and April, 1997, as part of the Phase II reuse area RI conducted by ICF Kaiser Engineers, Inc. (ICF KE). The purposes of the RI were to evaluate: 1) the nature and extent of contamination; and 2) the level of risk posed to human health and the environment. The final RI Report for the Phase II reuse area (USACE, 1999) was completed in January, 1999.

Four AREEs were identified in the RI as having soil contamination which poses unacceptable human health risks and/or significant adverse ecological effects:

- AREE 2 - Sewage Treatment Plant;

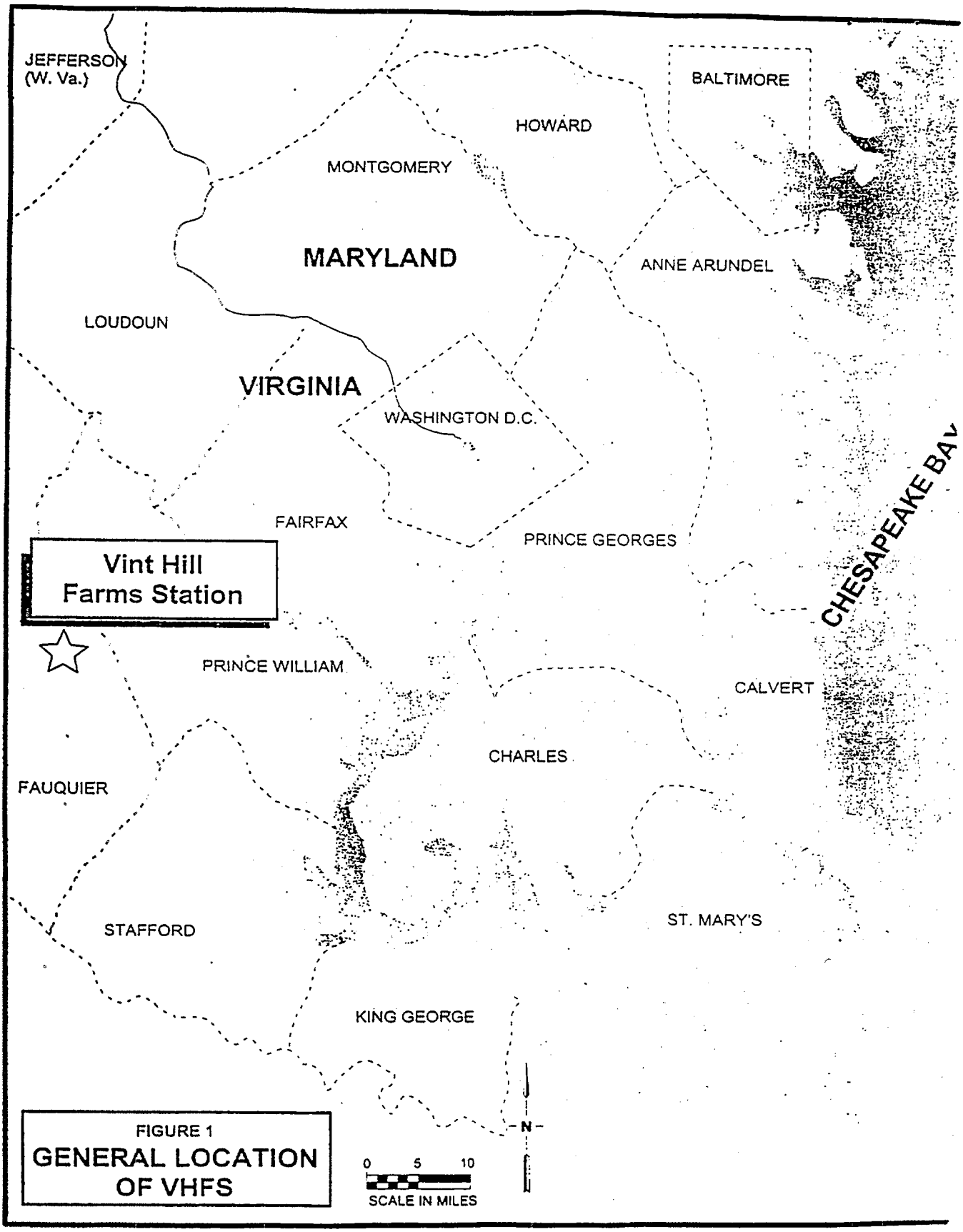


FIGURE 1
GENERAL LOCATION OF VHFS

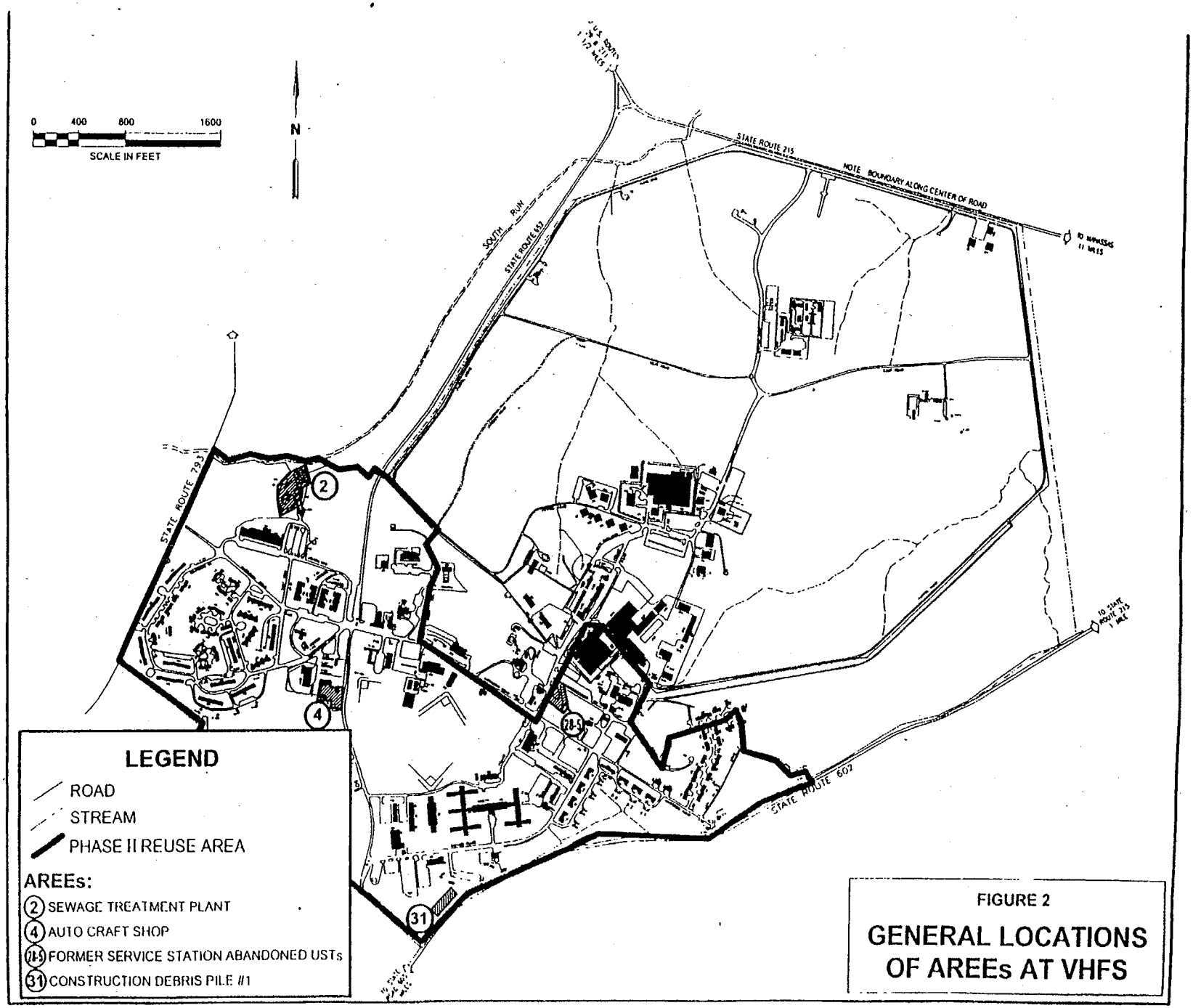


FIGURE 2

GENERAL LOCATIONS OF AREEs AT VHFS

- AREE 4 - Auto Craft Shop;
- AREE 28-5 - Former Service Station Abandoned USTs; and
- AREE 31 - Construction Debris Pile #1.

The locations of these AREEs are shown on Figure 2.

3.0 SITE CHARACTERISTICS

3.1 Site Topography

VHFS is located within the Piedmont Plateau physiographic province, approximately 20 miles west of the Fall Line. The Fall Line is a physiographic boundary that separates the folded and faulted crystalline rocks of the Piedmont Plateau physiographic province from the unconsolidated sediments of the Atlantic Coastal Plain physiographic province. The topography of the Piedmont Plateau in the vicinity of VHFS consists of gently rolling hills with slopes generally less than 10%. Surface elevations on the installation vary from 335 to 430 feet (ft) above mean sea level (MSL).

3.2 Adjacent Land Use

Land use in the immediate vicinity of VHFS consists mainly of agriculture (mostly horse farms) and residential areas. With the exception of a few residences to the north, the majority of residential development is located to the south of VHFS. A small county recreation park is located adjacent to VHFS along South Run.

3.3 Surface Water Hydrology

VHFS is located in the Occoquan watershed. Most of VHFS drains to South Run via intermittent tributaries and drainage ditches, as shown on Figure 2. South Run is a small Class III Virginia stream which discharges into Lake Manassas, a recreation and drinking water reservoir built on Broad Run for the City of Manassas. Lake Manassas discharges to Broad Run, which drains to the Occoquan Reservoir. Drainage for the southern portion of the installation flows south and east to Kettle Run. Kettle Run converges with Broad Run approximately 10 miles downstream from Lake Manassas.

3.4 Geology/Hydrogeology

The central portion of VHFS is underlain by folded sedimentary rocks of the Catharpin Creek Member which consists of sandstone, arkosic sandstone, siltstone, shale, and claystone. Intrusions of basalt, oriented northeast to southwest, cut the bedrock in the central and western portions of the VHFS installation. The northeastern flank of VHFS is underlain by intrusions of diabase. Quaternary alluvium is present along the major drainage channels within the installation.

The overburden is thickest (20-40 ft) in the southern regions of the site and thins to 0-10 ft in the northern areas. The overburden consists primarily of saprolite (a chemical and physical weathering product of the underlying bedrock) which underlies lesser amounts of clayey and silty soils.

Groundwater at VHFS occurs in fractured bedrock and to a lesser extent in the overburden. The bedrock aquifer is semi-confined, with the unfractured bedrock and saprolite acting as confining units. Recharge to the fractured bedrock aquifer occurs at outcrop areas and from percolation from the overburden along fractures. In the overburden, the aquifer is unconfined.

4.0 SITE HISTORY AND INVESTIGATION FINDINGS

The RI for these four AREEs was conducted to evaluate the nature and extent of contamination associated with past site activities. Environmental samples collected and analyzed during the RI were used in conjunction with the results from the SI to assess the condition of each of the AREEs. The environmental media investigated included surface soil (0 to 2 ft below ground surface [bgs]), subsurface soil (2 ft to approximately 10 ft bgs), surface water, sediment, and groundwater. Analytical results were compared to background concentrations and regulatory screening levels to determine if environmental media had been adversely impacted by site activities. A brief description of each of the four AREEs and the significant findings of the RI and SI are presented in the following paragraphs. A detailed presentation of the samples collected and the analytical results can be found in the Phase II Reuse Area RI Report (USACE, 1999), available in the Information Repository.

4.1 AREE 2 - Sewage Treatment Plant

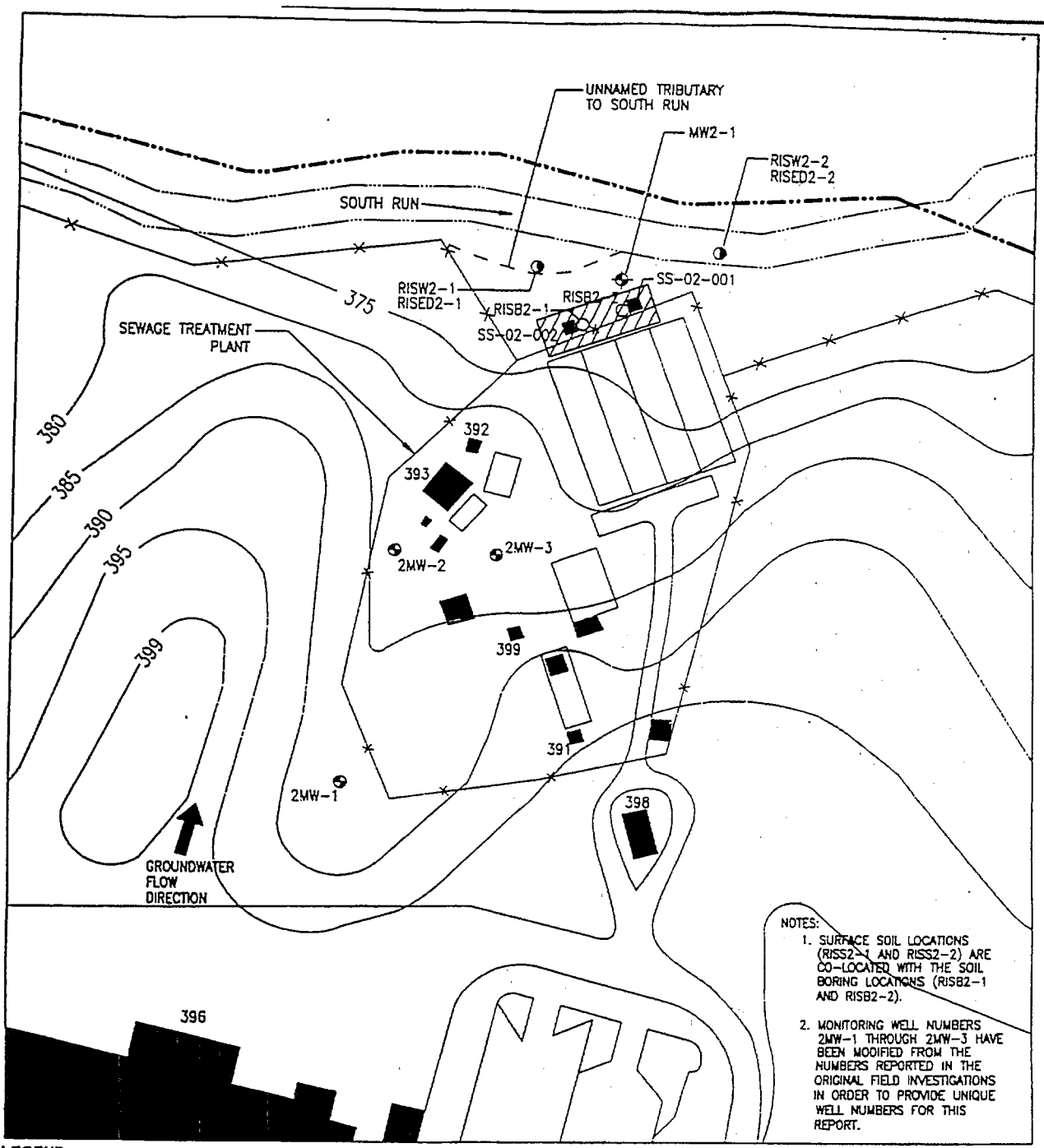
AREE 2 is the sewage treatment plant (STP) which serves permanent residents and daily employees at VHFS and has been in service since 1952. The plant has treated sanitary wastewater, industrial wastewater from VHFS operations (photographic, painting, laboratory, vehicle washing, and metal etching), and surface water runoff. The facility discharges treated effluent to South Run under a Virginia Pollutant Discharge Elimination System (VPDES) permit. Before 1980, sludge was stored in piles on the ground near South Run.

Surface soil, subsurface soil, sediment, surface water, and groundwater samples were collected at AREE 2 as shown on Figure 3. Metals were detected in surface soil above residential soil risk-based concentrations (RBCs) established by U.S. Environmental Protection Agency (USEPA) Region III for screening analytical results. Mercury (maximum concentration of 4.3 parts per million [ppm]) was detected above the residential soil RBC of 0.78 ppm in surface soil samples SS-02-001 and SS-02-002. Benzo(a)pyrene, a polynuclear aromatic hydrocarbon (PAH), was present above residential soil RBCs in one surface soil sample downgradient of the former sludge pile. Based on the results of the subsurface soil samples, subsurface soil has not been impacted by AREE 2 activities.

4.2 AREE 4 - Auto Craft Shop

The Auto Craft Shop (Buildings 306 and 308) was used as the motor pool from 1943 to 1967, and as a vehicle maintenance area where military personnel performed maintenance on their private vehicles from 1968 to 1994. The buildings were used to store oil, solvents, and lubricants for vehicle maintenance activities as well as spent solvent and waste oil filters. The buildings have concrete floors with no curbs or floor drains. Gasoline and oil spills have been recorded in this area and were cleaned up using absorbents. A 1,000-gallon UST was used to store waste oil prior to its removal in July, 1990. A plume of petroleum contamination currently lies under the shop as a result of leaks from the UST. A corrective action for this plume has been implemented. Three areas where surface runoff/discharge from AREE 4 occurs have been identified (see Figure 4). An outdoor vehicle wash rack near Building 308 drained into a grit chamber, which has been removed. The grit chamber was used to settle the solids prior to discharge of water from the vehicle wash rack via a ceramic pipe into the wooded area south of Building 308. The floor of the grit chamber and the associated contaminated soil were removed during the Phase II reuse area RI field investigation. A storm sewer drain located west of Buildings 306 and 308 discharged surface runoff to the field south of the Auto Craft Shop. Surface runoff also drains south of the Auto Craft Shop near the former hydraulic lift.

Surface soil, subsurface soil, and groundwater samples were collected at AREE 4 as shown on Figure 4. Surface and subsurface soil results are presented herein; groundwater results are presented in a separate Decision Document (DD) which addresses site-wide groundwater. TPH contamination, exceeding the Virginia TPH soil action level for USTs of 100 ppm, was present in surface soil samples collected near the storm sewer discharge area, former hydraulic lift surface runoff area, and wash rack discharge area. The maximum TPH concentration (1,860 ppm) was detected in surface soil sample SS-04-002 collected at the former hydraulic



LEGEND:

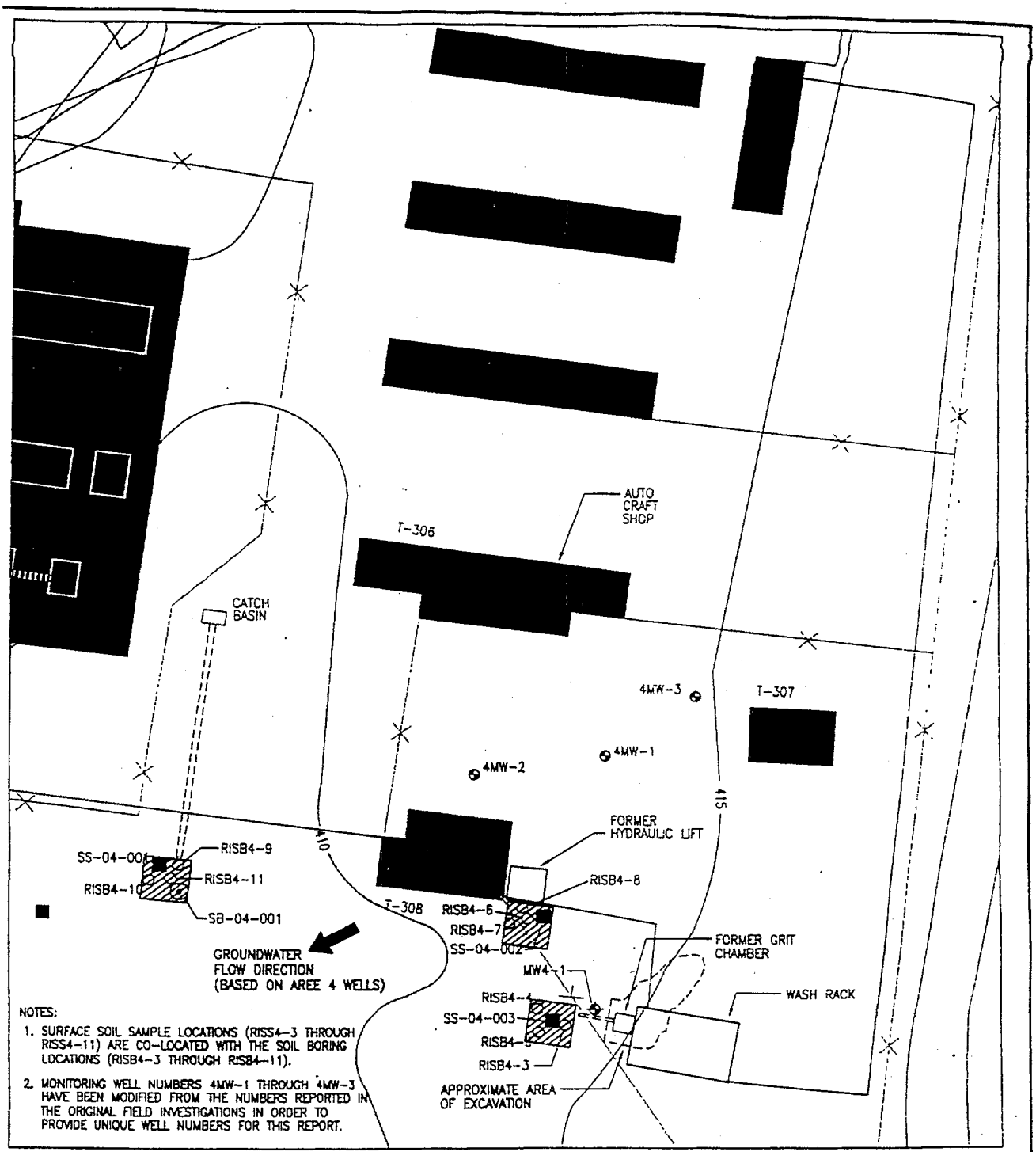
- IMPACTED SURFACE SOIL AREA (APPROXIMATE)
- BUILDING
- VHFS BOUNDARY
- PAVED ROAD
- FENCE
- STREAM
- TRIBUTARY
- 380 TOPOGRAPHIC CONTOUR (FT MSL)
- SI SURFACE SOIL SAMPLE LOCATION
- EXISTING MONITORING WELL
- PHASE II RI MONITORING WELL
- PHASE II RI SOIL BORING LOCATION
- PHASE II RI SURFACE WATER/SEDIMENT SAMPLE LOCATION

N

0 50 100

SCALE IN FEET

FIGURE 3
SI AND RI SAMPLE LOCATIONS FOR AREE 2 - SEWAGE TREATMENT PLANT



LEGEND:

- IMPACTED SURFACE SOIL AREA (APPROXIMATE)
- FENCE
- BUILDING
- ROAD
- STORM DRAIN
- 410 TOPOGRAPHIC CONTOUR (FT MSL)
- SI SOIL BORING LOCATION
- SI SURFACE SOIL SAMPLE LOCATION
- PHASE II RI SOIL BORING LOCATION
- EXISTING MONITORING WELL
- PHASE II RI MONITORING WELL

N

0 25 50

SCALE IN FEET

FIGURE 4

SI AND RI SAMPLE LOCATIONS FOR AREE 4 - AUTO CRAFT SHOP

lift surface runoff area. Metals were detected in surface soil above residential soil RBCs at all three surface runoff/discharge areas. Lead contamination exceeding the USEPA screening level for lead in residential soil of 400 ppm was detected in surface soil at all three surface runoff/discharge areas. The maximum lead concentration (1,700 ppm) was detected in a surface soil sample collected from the storm sewer discharge area. Four PAHs (benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, and indeno[1,2,3-cd]pyrene) exceeding the residential soil RBCs are present in surface soil at the wash rack discharge area. Only benzo(a)pyrene is present in surface soil above the residential soil RBC (0.087 ppm) in all three surface runoff/discharge areas. The maximum benzo(a)pyrene concentration of 1.52 ppm was detected in surface soil sample RISS4-5 located in the wash rack discharge area. Based on the results of the subsurface soil samples from the three surface runoff/discharge areas, contaminant concentrations in subsurface soil were all below screening levels.

4.3 AREE 28-5 - Former Service Station Abandoned USTs

AREE 28-5 consists of the Former Service Station Abandoned USTs located under the asphalt parking lot approximately 60 ft northwest of the former service station (Building 220). Three 5,000-gallon steel USTs were used for the storage of gasoline and diesel fuel products. The USTs were approximately 30 years old and were in service until 1983. Environmental Restoration Company (ERC) removed the USTs and associated pipelines in December, 1994.

Subsurface soil and groundwater samples were collected at AREE 28-5 as shown on Figure 5. TPH contamination, exceeding the Virginia TPH soil action level for USTs of 100 ppm, was detected in subsurface soil in the vicinity of the former pump island at depths ranging from 2 ft bgs to at least 10 ft bgs. The maximum TPH concentration (5,273 ppm) was detected at a depth of 8-10 ft bgs in soil boring RISB28-5-1.

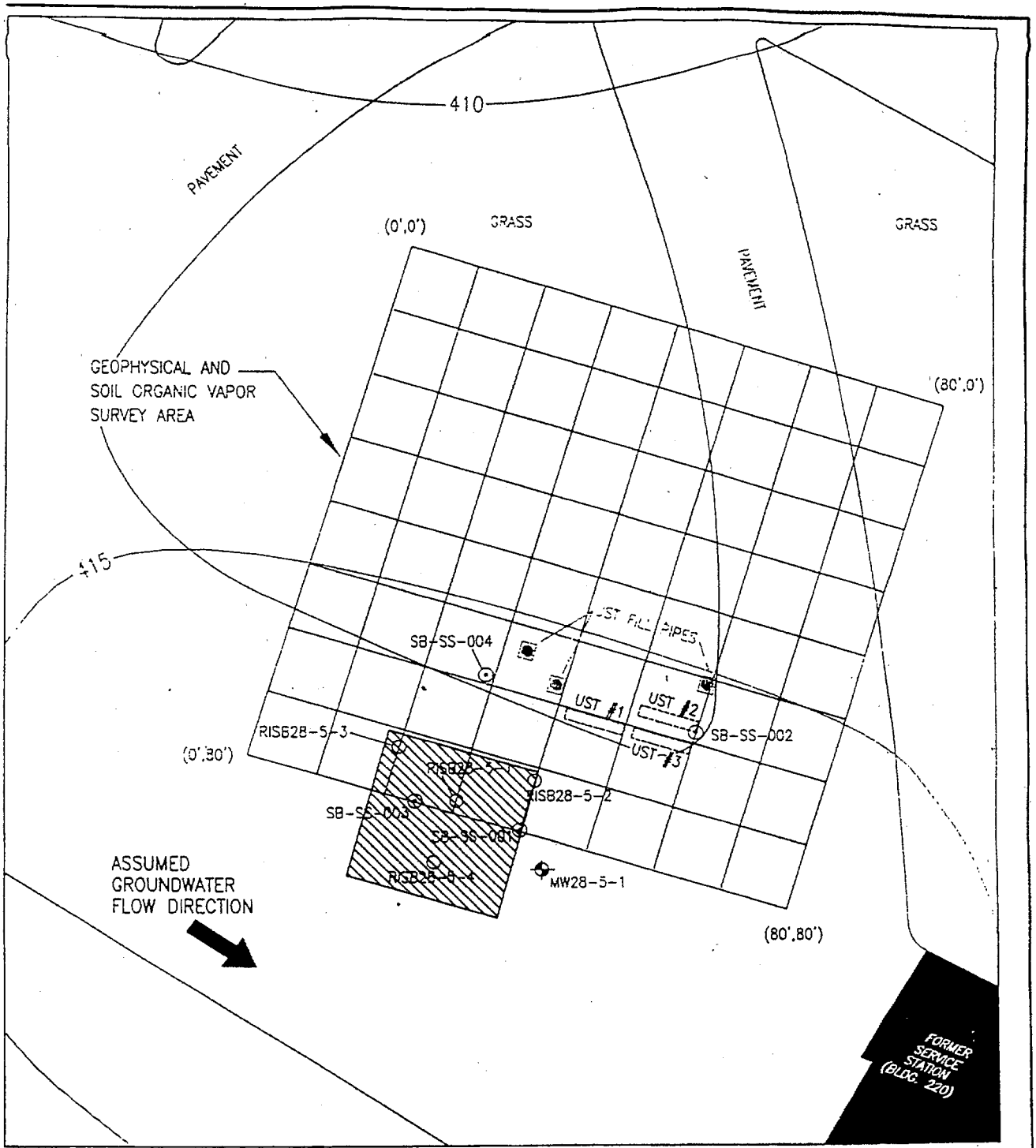
4.4 AREE 31 - Construction Debris Pile #1

AREE 31 is a construction debris pile located approximately 200 to 300 ft northwest of the southernmost tip of the VHFS property boundary in a predominantly wooded and vegetated area. The pile consists of construction debris including, but not limited to, concrete pipe, corrugated steel pipe, steel footers, antennae pillars, roofing paper, bricks, cinder blocks, cement slabs, and insulation material. The debris pile has an area of approximately 15 ft by 150 ft.

Surface and subsurface (from a test pit) soil samples were collected at AREE 31 as shown on Figure 6. Metals (copper and lead) and PAH contamination is present in surface soil sample RISS31-2. The lead concentration of 3,610 ppm exceeded the USEPA screening level for lead in residential soil of 400 ppm. Copper at 1,880 ppm exceeded its residential soil RBC of 310 ppm. Five PAHs (benzo[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[a]pyrene, and indeno[1,2,3-cd]pyrene) exceeded the residential soil RBCs by one or more orders of magnitude in surface soil sample RISS31-2. For example, benzo(a)pyrene was detected at 34.6 ppm compared to its residential soil RBC of 0.087 ppm. Subsurface soil has not been impacted by the debris present at AREE 31.

5.0 SUMMARY OF SITE RISKS

A BRA was conducted as part of the RI to assess the human health and ecological problems that could result if the contamination at the AREEs was not remediated. The Human Health Risk Assessment (HHRA) was prepared to evaluate the magnitude of potential adverse effects on human health associated with current industrial/commercial and potential future residential exposures to site-related chemicals at the AREEs. The Ecological Risk Assessment (ERA) was conducted to characterize the potential threats to ecological receptors posed by contaminants at the AREEs.



LEGEND:

- IMPACTED SOIL AREA (APPROXIMATE)
- BUILDING
- PAVED ROAD
- 410 TOPOGRAPHIC CONTOUR (FT MSL)
- UST FILL PIPE
- FORMER UST LOCATION
- SI SOIL BORING LOCATION
- PHASE II RI MONITORING WELL
- PHASE II RI SOIL BORING LOCATION

N

0 10 20

SCALE IN FEET

FIGURE 5

SI AND RI SAMPLE LOCATIONS FOR AREE 28-5 - FORMER SERVICE STATION USTs

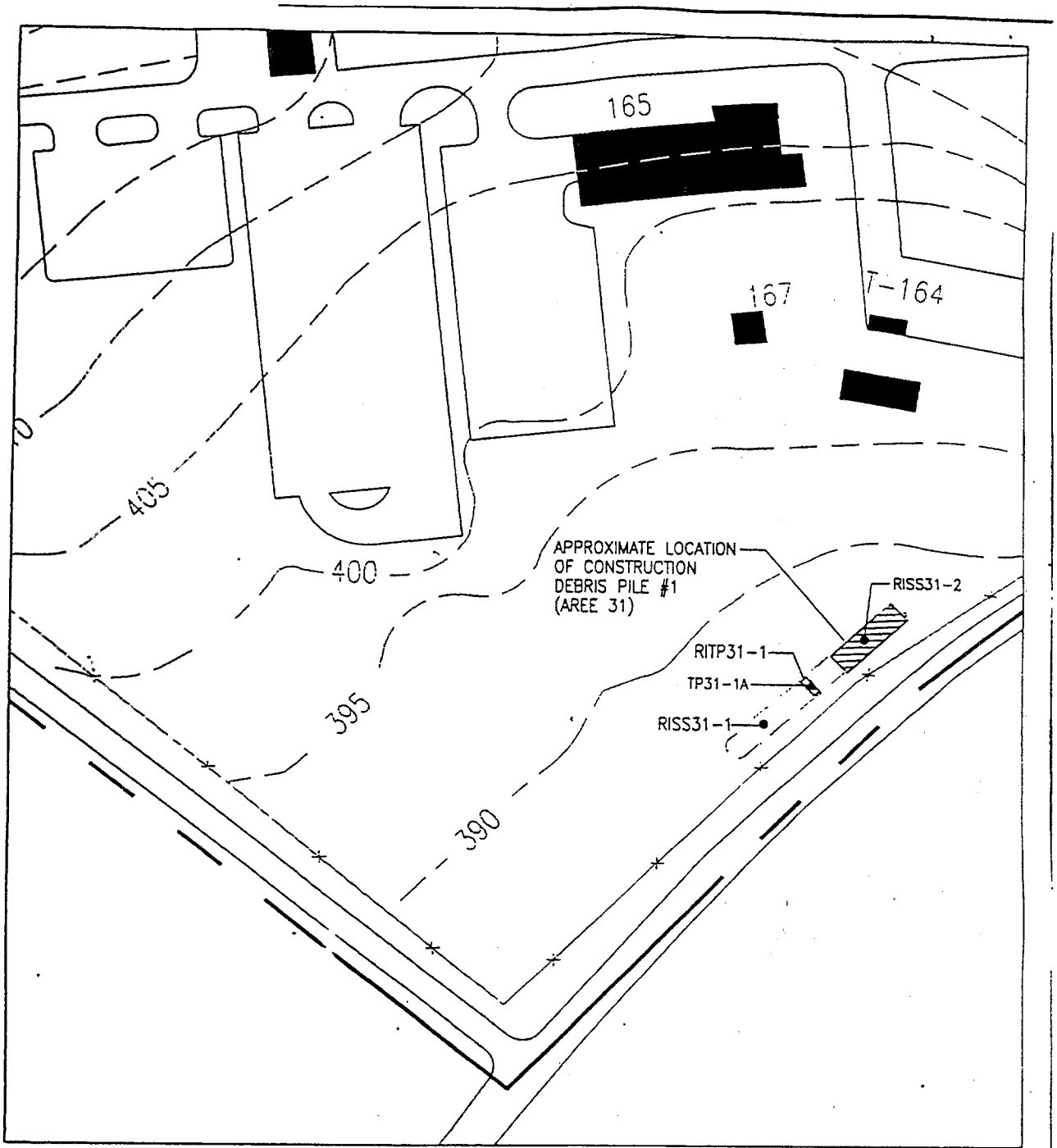


FIGURE 6
RI SAMPLE LOCATIONS FOR AREE 31 - CONSTRUCTION DEBRIS PILE #1

The HHRA follows a four-step process:

- Selection of Chemicals of Potential Concern - identifies the contaminants of potential concern based on their toxicity, frequency of occurrence, and concentration by comparing the maximum concentrations of detected chemicals with RBCs which are health-protective chemical concentrations that are back-calculated using toxicity criteria, a $1x10^{-6}$ target carcinogenic risk or a 0.1 hazard quotient (HQ, defined below), and conservative exposure parameters;

- Exposure Assessment - identifies the potential pathways of exposure, and estimates the concentrations of contaminants to which people may be exposed as well as the frequency and duration of these exposures;

- Toxicity Assessment - determines the toxic effects of the contaminants; and

- Risk Characterization - provides a quantitative assessment of the overall current and future risk to people from site contaminants based on the exposure and toxicity information.

The HHRA evaluated health effects which could result from exposure to soil, groundwater, surface water, and sediment contamination in the Phase II reuse area of VHFS. The HHRA evaluated potential risks to current workers who could be exposed to contaminants in surface soil, and to current trespassers who could be exposed to contamination in surface soil, surface water, and sediment. In addition, the HHRA evaluated potential risks to hypothetical future adult residents who could be exposed to contaminants in groundwater and surface soil and to hypothetical future child residents who could be exposed to contaminants in groundwater, surface soil, surface water, and sediment. Potential risks to future excavation workers who could be exposed to contaminants in subsurface soil were also evaluated in the HHRA. Subsurface soil was only evaluated for excavation workers and not residents since residents would be unlikely to be exposed to subsurface soil. In addition, the concentrations of contaminants currently present in subsurface soil would not be representative of the concentrations that might be present if landscaping activities were to occur which would involve mixing of subsurface soils with surface soil, clean topsoil, and other soil amendments. Therefore, it would not be appropriate to evaluate risks to residents using available subsurface soil data.

Potential carcinogenic (cancer-related) effects and noncarcinogenic effects (including various impacts on different organ systems, such as lungs, liver, etc.) were evaluated in the HHRA. Carcinogenic effects are expressed as the probability that an individual will develop cancer from exposure to the contaminants from each AREE. The evaluation of noncarcinogenic effects is based on the hazard index (HI), which is the summation of the HQs for individual chemicals. The HQ is a comparison of chemical-specific chronic exposure doses with the corresponding protective doses derived from health criteria. The USEPA recommends that remedial actions may be warranted at sites where the carcinogenic risk to any person is greater than $1x10^{-4}$ or the HI is greater than 1. A carcinogenic risk of $1x10^{-4}$ means that there is a potential of one additional person in a population of 10,000 developing cancer from exposure to contaminants at an AREE if the AREE is not remediated. A HI greater than 1 indicates a potential for noncarcinogenic health effects if the AREE is not remediated.

The ERA also follows a four-step process:

- Problem Formulation - develops information that characterizes habitats and potentially exposed species and identifies contaminants of concern, exposure pathways, and receptors;

- Exposure Assessment - estimates exposure point concentrations for selected indicator species;

- Ecotoxicologic Effects Assessment - identifies concentrations or doses of contaminants that are protective of indicator species; and

- Risk Characterization - estimates potential adverse effects from exposure to contaminants based on exposure and toxicity information.

The ERA evaluated ecological effects which could result from exposure to surface soil, surface water, and sediment contamination in the Phase II reuse area of VHFS. The ERA evaluated potential adverse ecological effects to terrestrial plants and terrestrial invertebrates (represented by earthworms) exposed to contaminants in surface soil. In addition, potential adverse ecological effects to mammals (represented by shrews) and birds (represented by robins) through bioaccumulation in the food web and exposure to contaminants in surface soil were evaluated. Potential adverse ecological effects to aquatic life from exposure to contaminants in surface water and sediment were also evaluated in the ERA. Further, the potential adverse ecological effects to mammals (represented by minks) and birds (represented by herons) through bioaccumulation in the food web and exposure to contaminants in sediment were evaluated.

The evaluation of significant potential adverse ecological effects is based on the Environmental Effects Quotient (EEQ). The EEQ is the ratio of the estimated exposure concentrations/doses for the chemicals of potential concern and the toxicity reference values (TRVs) for the ecological receptors. If the EEQ is greater than 1, there is a potential for adverse ecological effects to occur. As the magnitude of the EEQ becomes greater than 1, the potential for adverse ecological effects becomes more significant.

The results of the BRA for the four AREEs are presented in the following paragraphs. A detailed presentation of the BRA can be found in the Phase II Reuse Area RI Report (USACE, 1999), available in the Information Repository.

5.1 AREE 2 - Sewage Treatment Plant

The HHRA determined that, under both current industrial/commercial and potential future residential land-use conditions, the risks to workers, trespassers, residents, and excavation workers are acceptable for exposure to site-related contaminants at AREE 2. Discounting naturally-occurring metals that were statistically determined to be within background concentrations, the highest estimated upper-bound excess lifetime cancer risk ($1X10^{-5}$) is for child residents exposed to site-related contaminants in surface soil by incidental ingestion. and the highest noncarcinogenic risk (HI=5) is for child residents exposed to site-related contaminants in surface soil by incidental ingestion. The contaminant that drove the elevated HI at AREE 2 is iron which was detected at comparable levels in similar surface soil types in background locations and is, therefore, not site-related.

The ERA determined that contaminants in surface soil at AREE 2 pose significant potential adverse ecological effects. The significant potential adverse ecological effects result primarily from mercury. Mercury results in significant potential adverse ecological effects for terrestrial plants, earthworms, robins, and shrews, with the greatest potential adverse ecological effects occurring to robins (EEQ of 3,500).

The mercury contamination downgradient of the former sludge pile is recommended for remediation. The impacted area has approximate dimensions of 75 ft by 25 ft by 2 ft deep, as shown on Figure 3.

5.2 AREE 4 - Auto Craft Shop

The HHRA concluded that, under both current industrial/commercial and potential future residential land-use conditions, the risks to workers, trespassers, residents, and excavation workers are acceptable for exposure to site-related contaminants, except for lead, in soil at AREE 4. Discounting naturally-occurring metals that were statistically determined to be within background concentrations, the highest estimated upper-bound excess lifetime cancer risk ($3X10^{-5}$) is for child residents exposed to site-related contaminants in surface soil by incidental ingestion, and the highest noncarcinogenic risk (HI=0.5) is for child residents exposed to site-related contaminants in surface soil by dermal absorption.

The human health risks associated with exposure to lead contamination in surface soil at AREE 4 were evaluated using the Integrated Exposure Uptake Biokinetic (IEUBK) Model recommended by USEPA for evaluating lead exposures for young children in residential settings. The IEUBK Model calculates blood lead levels which result from exposures to lead which may then be compared to blood lead levels of toxicological significance for purposes of risk evaluation. The IEUBK Model run for AREE 4 predicted a geometric mean blood lead level of 6.9 µg/dL, with 19.81 percent of the population exceeding the blood lead level of concern (10 µg/dL). The USEPA currently finds 5 percent of the population exceeding the blood lead level of concern acceptable. Therefore, the IEUBK model results indicate that if AREE 4 was developed for residential use in the future, the lead concentrations in the surface soil may be a potential problem for young children.

The ERA determined that metals in surface soil at AREE 4 pose significant potential adverse ecological effects. The significant potential adverse ecological effects result primarily from lead, selenium, mercury, and zinc. Lead, selenium, and zinc result in significant potential adverse ecological effects to terrestrial plants with EEQs of 34, 38, and 15, respectively. Mercury results in significant potential adverse ecological effects to robins (EEQ of 210) and shrews (EEQ of 13).

The metals contamination in the surface soil at the three surface runoff/discharge areas is recommended for remediation. The approximate dimensions of the impacted area at each of the three surface runoff/discharge areas are 15 ft x 15 ft x 2 ft deep, as shown on Figure 4.

5.3 AREE 28-5 - Former Service Station Abandoned USTs

The ERA did not evaluate AREE 28-5 because this area is covered with asphalt, thus eliminating the potential for exposure to ecological receptors.

The HHRA determined that contamination at AREE 28-5 does not pose an unacceptable human health risk under either current industrial/commercial or potential future residential land-use conditions. In fact, no chemicals of potential concern were identified in subsurface soil at AREE 28-5 in the HHRA. However, risks associated with exposures to TPH could not be assessed in the BRA because this analytical parameter represents a mixture of chemical constituents. Since TPH measurements give no indication of the chemical constituents present or their respective concentrations, they cannot be used to predict risks. Although risks associated with TPH cannot be estimated, TPH contamination in subsurface soil in the vicinity of the former pump island at AREE 28-5 exceeds the Virginia TPH soil action level for USTs and is, therefore, recommended for remediation. The impacted area is approximately 20 ft x 20 ft x 10 ft deep (minimum), as shown on Figure 5.

5.4 AREE 31 - Construction Debris Pile #1

The HHRA determined that, under current industrial/commercial land-use conditions, the risks to workers and trespassers are acceptable for exposure to contaminants in surface soil at AREE 31. Under potential future residential land-use conditions, assuming that AREE 31 is not remediated, the risks to potential adult and child residents are unacceptable for exposure to contaminants in surface soil at AREE 31. The highest estimated upper-bound excess lifetime cancer risk is for child residents exposed to contaminants in surface soil by incidental ingestion; this risk is $4x10^{-4}$ (i.e., 4 in 10,000 residents may develop cancer caused by exposure to contaminants in surface soil at AREE 31). Cancer risks were due primarily to exposures to benzo(a)pyrene and other PAHs. Discounting naturally-occurring metals that were statistically determined to be within background concentrations, the highest noncarcinogenic risk is for child residents exposed to contaminants in surface soil by incidental ingestion; the HI is estimated to be 0.7.

As explained in the AREE 4 discussion, lead contamination in surface soil at AREE 31 was evaluated using the IEUBK Model which predicted a geometric mean blood lead level of 15 µg/dL, with 78.4 percent of the population exceeding the blood lead level of concern (10 µg/dL). Again, the USEPA currently finds 5 percent of the population exceeding the blood lead level of concern acceptable. Therefore, the IEUBK Model

results indicate that if AREE 31 was developed for residential use in the future, the lead concentrations in the surface soil may be a potential problem for young children.

The ERA determined that contaminants in surface soil at AREE 31 pose significant potential adverse ecological effects. The significant potential adverse ecological effects result primarily from metals (copper, lead, mercury, and selenium) and one PAH (benzo[a]pyrene). Mercury results in significant potential adverse ecological effects for robins and shrews, with the greatest potential adverse ecological effects occurring to robins (EEQ of 250). Copper results in significant potential adverse ecological effects for terrestrial plants and earthworms, with the greatest potential adverse ecological effects occurring to earthworms (EEQ of 38). Selenium and lead result in significant potential adverse ecological effects for terrestrial plants with EEQs of 25 and 72, respectively. Benzo(a)pyrene results in significant potential adverse effects to earthworms with an EEQ of 13.

The most significant contamination at AREE 31 is in surface soil in the vicinity of surface soil sample RISS31-2 located in the northeastern portion of the debris pile, which is recommended for remediation. The impacted area has approximate dimensions of 50 ft x 15 ft x 2 ft, as shown on Figure 6.

6.0 REMEDIAL ACTION OBJECTIVES

Remedial action objectives are specific goals to protect human health and the environment. The remedial action objective for the four AREEs is to minimize the potential for contaminated soil to pose unacceptable risks to human or ecological receptors.

7.0 CLEANUP LEVELS ESTABLISHED FOR THE SELECTED ALTERNATIVE

USEPA has established soil cleanup levels for the contaminants that contribute to the unacceptable risk determination at each of the four AREEs. The soil cleanup levels are presented in Table 1. The soil cleanup level for AREE 2 is based on concentrations which are protective of ecological receptors (EEQ=10). The soil cleanup level for lead in surface soil at AREEs 4 and 31 is based on the USEPA screening level for lead in residential soil of 400 ppm. The soil cleanup levels for other metals at AREE 4 are based on concentrations which are protective of ecological receptors. The soil cleanup level for AREE 28-5 is based on the Virginia TPH soil action level for USTs of 100 ppm. USEPA established the soil cleanup levels for PAHs at AREE 31 based on a $1X10^{-6}$ (one in 1,000,000 people) upper-bound excess lifetime cancer risk for the potential future residential use scenario. The soil cleanup levels for metals, other than lead, at AREE 31 are based on concentrations which are protective of ecological receptors.

8.0 SUMMARY OF REMEDIAL ALTERNATIVES

Two remedial alternatives were evaluated to address soil contamination at AREEs 2, 4, 28-5, and 31. The range of remedial alternatives considered was limited by the nature and extent of the contamination. Since the amount of soil requiring remediation is relatively small (approximately 400 cubic yards), it was not practical to consider active treatment or containment options in terms of cost-effectiveness and implementability. The following remedial alternatives were evaluated:

- Alternative 1 - No Action; and
- Alternative 2 - Soil Removal.

Table 1
Cleanup Levels Established for Soil at the Four AREEs

Constituents	Cleanup Levels (ppm)
AREE 2 – SEWAGE TREATMENT PLANT	
Mercury (Ecological risk)	0.192 (a)
AREE 4 – AUTO CRAFT SHOP	
Lead (Human Health & Ecological risk)	400 (d)
Mercury (Ecological risk)	0.534 (a)
Selenium (Ecological risk)	10 (a)
Zinc (Ecological risk) (c)	500 (a)
AREE 28-5 – FORMER SERVICE STATION ABANDONED USTs	
TPH	100 (e)
AREE 31 – CONSTRUCTION DEBRIS PILE #1	
Benzo(a)anthracene (Human Health risk)	0.87 (b)
Benzo(a)pyrene (Human Health & Ecological risk)	0.087 (b)
Benzo(b)fluoranthene (Human Health risk)	0.87 (b)
Benzo(k)fluoranthene (Human Health risk) (c)	8.7 (b)
Copper (Ecological risk)	500 (a)
Indeno(1,2,3-cd)pyrene (Human Health risk)	0.87 (b)
Lead (Human Health & Ecological risk)	400 (d)
Mercury (Ecological risk)	0.48 (a)
Selenium (Ecological risk)	10 (a)

TPH – total petroleum hydrocarbons
USTs – underground storage tanks
(a) Based on a concentration which is protective of ecological receptors (EEQ=10).
(b) Human health cleanup levels are based on a $1X10^{-6}$ upper-bound excess lifetime cancer risk for the potential future residential land-use scenario.
(c) These compounds contribute to but do not drive unacceptable risk.
(d) USEPA screening level for lead in residential soil.
(e) Virginia TPH soil action level for USTs.

8.1 Alternative 1 - No Action

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), require that a No Action alternative be considered as a baseline for comparison to other alternatives. No action would be taken to address site contamination under this alternative. In accordance with Section 121 of CERCLA, each AREE would be reviewed at least once every five years to re-evaluate site conditions and to determine the need for remedial action to protect human health and the environment.

8.2 Alternative 2 - Soil Removal

Under this alternative, all contaminated soil exceeding the established cleanup levels would be excavated, transported off site by truck, and disposed using a combination of permitted off-site hazardous waste, construction debris, and/or municipal landfills, as appropriate based on analytical results. Approximately 400 cubic yards of impacted soil would be excavated as part of this alternative, followed by confirmation sampling to assure adequate removal of all soil exceeding the cleanup levels. Upon completion of the soil excavation, disturbed areas would be backfilled, regraded, and either vegetatively stabilized or paved (AREE 28-5). The five-year review does not apply to this alternative because hazardous substances above risk-based cleanup levels would not remain on site.

9.0 EVALUATION OF ALTERNATIVES

CERCLA requires a comparison of the alternatives using nine evaluation criteria: overall protection of human health and the environment; compliance with applicable or relevant and appropriate requirements (ARARs); long-term effectiveness and permanence; reduction of toxicity, mobility or volume through treatment; short-term effectiveness; implementability; cost; and regulator and community acceptance. The first two criteria are considered by USEPA to be threshold criteria which must be met by each alternative. The nine evaluation criteria are described below:

- Overall protection of human health and the environment addresses whether or not a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

- Compliance with ARARs addresses whether or not a remedy will meet all of the applicable or relevant and appropriate requirements of other federal and state environmental statutes and requirements or provides grounds for invoking a waiver.

- Long-term effectiveness and permanence refers to the ability of a remedy to maintain reliable protection of human health over time, once cleanup goals have been met.

- Reduction of toxicity, mobility, or volume through treatment is the anticipated performance of the treatment technologies a remedy may employ.

- Short-term effectiveness addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period until cleanup goals are achieved.

- Implementability is the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement a particular option.

- Cost includes estimated capital and operation and maintenance costs, and net present worth costs.

- Regulator acceptance indicates whether, based on their review of the RI and Proposed Plan, the regulators (the Virginia Department of Environmental Quality [VDEQ] and USEPA) concur, oppose, or have no comment on the selected alternative.

- Community acceptance is assessed in the Responsiveness Summary which summarizes the public comments received on the RI and the Proposed Plan.

The comparative analysis of the alternatives was conducted based upon these evaluation criteria, and is described below.

9.1 Overall Protection of Human Health and the Environment

The no action alternative (Alternative 1) is not protective of human health or the environment because the risks to potential future residents and the potential adverse effects to ecological receptors remain unchanged, which is unacceptable. Therefore, the no action alternative was eliminated from further consideration and will not be discussed further.

Alternative 2 provides adequate protection of human health and the environment by removing contaminated soil, thereby eliminating the potential for exposure.

9.2 Compliance with ARARs

Alternative 2 has been designed to achieve or comply with ARARs. This alternative will satisfy the established cleanup levels since all soil that is contaminated above applicable cleanup levels will be removed. In addition, the removal and disposition of contaminated soil during implementation of Alternative 2 would be done in accordance with federal and Virginia solid and hazardous waste regulations. During soil excavation, the Regulations of the Virginia Air Pollution Control Board may apply. Ambient air conditions would be monitored during excavation activities to assure acceptable air quality. As necessary based on the ambient air monitoring, water sprays would be used to keep dust levels down.

9.3 Long-term Effectiveness and Permanence

Alternative 2 would provide for the permanent removal of contaminated soil to a permitted off-site location designed to prevent contaminant migration and exposures to human and ecological receptors.

9.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternative 2 provides reduction of contamination at the AREEs by removing contaminated soil. The toxicity and volume of the contaminated soil would not be affected by this alternative; however, the mobility of the contaminants would be reduced because the off-site disposal facilities used would be designed to prevent contaminant migration.

Because treatment of the contaminated soil at the AREEs was not found to be practicable due to the small volume of impacted soil, Alternative 2 does not satisfy the statutory preference for treatment as a principal element of the remedy.

9.5 Short-term Effectiveness

Alternative 2 is considered to be effective in the short term because the volume of soil to be excavated is relatively small and would result in limited negative impacts to human health or the environment. Dust

exposure to workers and adjacent residents would be controlled during excavation activities by water sprays as needed. Prior to excavation operations, temporary erosion control structures would be installed to prevent entry of storm water into the soil excavation areas and prevent erosion and movement of soil from contaminated areas. Although truck traffic would be increased during implementation of Alternative 2, the implementation period (approximately one month) is short and the number of trucks per day would be less than 20.

9.6 Implementability

Alternative 2 is considered readily implementable. Licensed transporters and permitted disposal facilities are currently available.

9.7 Cost

The cost to implement Alternative 2 is estimated at $260,000.

9.8 Regulator Acceptance

VDEQ and USEPA concur with the selected remedy.

9.9 Community Acceptance

A public meeting on the Proposed Plan was held on April 9, 1998, in Warrenton, Virginia. Comments received during the public meeting and the public comment period are referenced in the Responsiveness Summary (Section 12 of this DD).

10.0 SELECTED REMEDY AND STATUTORY DETERMINATIONS

10.1 Selected Remedy

Following review and consideration of the information in the Information Repository, requirements of CERCLA and the NCP, and the review of public comments on the Proposed Plan, the U.S. Army, in coordination with VDEQ and USEPA, has selected Alternative 2, Soil Removal, as the remedy for the contaminated soil at AREEs 2, 4, 28-5, and 31.

Under this remedy, all contaminated soil exceeding the established cleanup levels would be excavated, transported off site by truck, and disposed using a combination of permitted off-site hazardous waste, construction debris, and/or municipal landfills, as appropriate based on analytical results. Approximately 400 cubic yards of impacted soil would be excavated as part of this remedy, followed by confirmation sampling to assure adequate removal of all soil exceeding the cleanup levels (refer to Table 1). Upon completion of the soil excavation, disturbed areas would be backfilled, regraded, and either vegetatively stabilized or paved (AREE 28-5).

The estimated cost to implement this remedy is $260,000, and the on-site activities would require approximately one month to complete.

10.2 Statutory Determinations

Under CERCLA Section 121, selected remedies must be protective of human health and the environment, must comply with ARARs (unless a statutory waiver is justified), must be cost-effective, and must utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment

that permanently and significantly reduces the volume, toxicity, or mobility of hazardous waste as their principal element. The following sections discuss the remedy in light of these statutory requirements.

10.2.1 Protection of Human Health and the Environment

The selected remedy would protect human health and the environment. All contaminated soil exceeding the established cleanup levels will be removed and disposed of in permitted, off-site facilities. The cleanup levels listed in Table 1 were developed to be protective of human health and the environment.

Short-term risks would be present as a result of dust exposure to workers and adjacent residents, soil erosion and sedimentation during excavation activities, and transport of contaminated soil off site. These risks would be acceptable as a result of control measures which would be implemented during the remedial action. These control measures include use of water sprays during excavation operations to control dust, and use of silt fences and other erosion control techniques to control erosion and soil movement from contaminated areas. The increase in truck traffic would be minimal, with the addition of less than 20 trucks per day over the course of approximately one month.

10.2.2 Compliance with ARARs

The selected remedy will be in full compliance with ARARs:

- 9 Virginia Administrative Code (VAC) 20-80-10 et seq.: Virginia Solid Waste Management Regulations – the disposal of any soil, debris, sludge or any other solid waste must be done in compliance with the regulations;
- 9 VAC 20-60-10 et seq.: Virginia Hazardous Waste Management Regulations – the disposal of any hazardous waste must be done in compliance with the regulations;
- 4 VAC 50-30-10, et seq.: Virginia Erosion and Sedimentation Control Regulations – an erosion and sedimentation control plan that complies with the minimum design and implementation standards of the regulations will be prepared before engaging in any land disturbing activity;
- 9 VAC 5-10-10 through 9 VAC 5-80-350: Regulations of the Virginia Air Pollution Control Board – ambient air monitoring will be used to determine the need for water sprays to control dust generation in order to comply with ambient air quality standards for particulate matter.

10.2.3 Cost-Effectiveness

The selected remedy affords overall effectiveness proportional to its costs. All contaminated soil exceeding the established cleanup levels will be removed from AREEs 2, 4, 28-5, and 31. The entire remedy will be achieved for approximately $260,000.

10.2.4 Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable

The selected remedy utilizes permanent solutions to the maximum extent practicable while providing the best balance among the other evaluation criteria. It achieves the best balance of tradeoffs with respect to the primary balancing criteria of long-term effectiveness and permanence; reduction of toxicity, mobility, and volume through treatment; short-term effectiveness; implementability; and cost; while also considering regulator and community acceptance.

The selected remedy provides a high degree of long-term effectiveness and permanence as the removal and off-site disposal of the contaminated soil would be permanent and irreversible. The variety of contaminants present in the soil at AREEs 2, 4, 28-5, and 31 and the relatively small volume of contaminated soil cause on-site treatment technologies to be impracticable and not cost-effective. The selected remedy is

easily implementable, with a relatively short time frame needed for design development. There is minimal risk to the community during the implementation of the selected remedy, and the slight risks to the environment can be reduced by implementing standard procedures, such as erosion and sedimentation controls.

10.2.5 Preference for Treatment as a Principal Element

Because treatment of the principal threat at AREEs 2, 4, 28-5, and 31 was not found to the practicable, this remedy does not satisfy the statutory preference for treatment as a principal element of the remedy.

11.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION

The Proposed Plan for AREEs 2, 4, 28-5, and 31 was released to the public on March 26, 1998 (see Attachment 1). This document was made available for public review in the Information Repository at the following location:

Fauquier County Library
Warrenton Branch - Reference Section
11 Winchester Street, Warrenton, VA
(540) 347-8750
Monday – Wednesday: 10:00 a.m. to 9:00 p.m.
Thursday – Saturday: 9:00 a.m. to 5:00 p.m.
Sunday: 1:00 p.m. to 5:00 p.m.

The notice of availability of the Proposed Plan (see Attachment 3) was published in The Fauquier Citizen, the Fauquier Times-Democrat, and the Manassas Journal Messenger during the week of March 23, 1998. A public comment period was held from March 26, 1998, through April 24, 1998. In addition, a public meeting was held on April 9, 1998, to present the Proposed Plan for AREEs 2, 4, 28-5, and 31 and to answer questions and receive public comments. The public meeting minutes have been transcribed, and a copy of the transcript is available to the public at the aforementioned location. A Responsiveness Summary, included as part of this DD, has been prepared to respond to the significant comments, criticisms, and new relevant information received during the comment period. Upon signing the DD, the U.S. Army will publish a notice of availability of this DD in The Fauquier Citizen, the Fauquier Times-Democrat, and the Manassas Journal Messenger, and place the DD in the Information Repository.

12.0 RESPONSIVENESS SUMMARY

The purpose of this Responsiveness Summary is to provide the public with a summary of citizen comments, concerns, and questions about AREEs 2, 4, 28-5, and 31. A public meeting was held on April 9, 1998, to present the Proposed Plan and to answer questions and receive comments. At the public meeting, one citizen had a question regarding the Proposed Plan. No written public comments were received during the March 26, 1998, through April 24, 1998, comment period.

The Responsiveness Summary is divided into the following sections:

- Selected newspaper notices announcing dates of the public comment period and location and time of the public meeting;
- Comments raised during the public meeting on April 9, 1998;
- Public meeting attendance roster; and
- Restoration Advisory Board Members.

All comments and concerns summarized in this document have been considered by the U.S. Army in making a decision regarding the selected alternative.

12.1 Selected Newspaper Notices

A public notice announcing the availability of the Proposed Plan and the public meeting was published in The Fauquier Citizen, the Fauquier Times-Democrat, and the Manassas Journal Messenger during the week of March 23, 1998. This public notice is provided in Attachment 3.

12.2 Comments Raised During the Public Meeting on April 9, 1998

One citizen raised a comment during the public meeting. The citizen's question and the U. S. Army's response are presented below:

CONCERNED CITIZEN: Is AREE 31 located directly under the trees or beyond the stand of trees?

ARMY RESPONSE: AREE 31 is located within the tree line.

12.3 Public Meeting Attendance Roster

The public meeting was held on April 9, 1998, at the Warrenton Middle School. The members of the community that attended the public meeting included Owen Bludau.

12.4 Restoration Advisory Board Members

1. Debra Reedy, Community Co-Chair
2. Richard Reisch, U.S. Army Co-Chair
3. Dean Eckelberry
4. John Mayhugh
5. Jeff Lippincott
6. Owen Bludau
7. Tim Tarr
8. Norris Goff
9. Erich Meding
10. Kevin Bell
11. Mark Stevens
12. Nancy Inger
13. Joanne Smith
14. Henry Ross
15. Steve Mihalko
16. Robert Stroud
17. Steve Maddox
18. William Downey
19. Gina Tyo
20. Joe Phelan
21. Mike Molloy
22. Denny Adams
23. Joe Wiltse
24. Bob Root
25. Georgia Herbert
26. Robert Kube
27. Kimberly Davis
28. George Rosenberger
29. Adrienne Garreau

30. Susan Dove
31. James Tucker
32. John Williams

13.0 REFERENCES

U.S. Army Corps of Engineers (USACE). 1999. Remedial Investigation Report. Vint Hill Farms Station Phase II Reuse Area Remedial Investigation. Final Document. Prepared by ICF Kaiser Engineers, Inc. Edgewood, Maryland. January, 1999.

U.S. Army Environmental Center (USAEC). 1996. Site Inspection Report with Supplemental Hydrogeologic Investigation. Vint Hill Farms Station. Warrenton, Virginia. Final Document. Prepared by Science Applications International Corporation, McLean, Virginia. June, 1996.

ATTACHMENT 1

PROPOSED PLAN

Proposed Plan

AREEs 2, 4, 28-5, and 31
Vint Hill Farms Station, Virginia

March 1998

INTRODUCTION

The U.S. Army has identified a preferred alternative to address contaminated soil at selected Areas Requiring Environmental Evaluation (AREEs) located on Vint Hill Farms Station (VHFS). The major characteristics of the U.S. Army's preferred alternative (Alternative 2 in this Proposed Plan) include excavation of contaminated soil and off-site disposal at a permitted facility.

This Proposed Plan is based on site-related documents contained in the VHFS Information Repository. The Information Repository can provide you with important information about the site and the four AREEs. The Information Repository is located at:

Fauquier County Library
Warrenton Branch - Reference Section
11 Winchester Street, Warrenton, VA
(540) 347-8750
Monday - Wednesday: 10:00 a.m. to 9:00 p.m.
Thursday - Saturday: 9:00 a.m. to 5:00 p.m.
Sunday: 1:00 p.m. to 5:00 p.m.

The U.S. Army needs your comments and suggestions. The U.S. Army, the U.S. Environmental Protection Agency (USEPA) Region III, and the Virginia Department of Environmental Quality (VDEQ) encourage the public to review and comment on both of the alternatives presented in the Proposed Plan. The public comment period begins on March 26, 1998, and closes on April 24, 1998. Please send your comments, postmarked no later than April 24, 1998, to:

Kevin Bell, Public Affairs Officer
Public Affairs Office (Bldg. 2500)
Vint Hills Farm Station
Warrenton, VA 20187-5001

In addition, you are invited to a public meeting regarding the investigation and cleanup of contamination at the selected AREEs at VHFS. Representatives from the U.S. Army will report on cleanup alternatives considered and the U.S. Army's preferred alternative. The meeting is scheduled for:

Thursday, April 9, 1998 at 7:00 p.m.
Warrenton Middle School Auditorium
244 Waterloo Street, Warrenton, VA

Special provisions will be made for the handicapped and hearing impaired.

The remedy described in this Proposed Plan is the U.S. Army's preferred alternative for the selected AREEs. The U.S. Army may modify the preferred alternative or select another remedial alternative if public comments or additional data indicate that such a change will result in a more appropriate remedial action. The U.S. Army, in consultation with USEPA and VDEQ, will make a remedy selection for the AREEs in a Decision Document after the public comment period has ended and the comments and information submitted during that time have been reviewed and considered.

The U.S. Army is issuing this Proposed Plan as part of its public participation responsibilities under Sections 113(k) and 117(a) of the Comprehensive Environmental Response, Compensation, and Liability Act

(CERCLA), as amended, commonly known as the "Superfund Program", and the National Environmental Policy Act of 1969 (NEPA). This Proposed Plan focuses on AREEs 2, 4, 28-5, and 31. Other areas of VHFS that the U.S. Army plans to remediate are addressed by separate Proposed Plans.

SITE BACKGROUND

VHFS is part of the U.S. Army Communications - Electronics Command (CECOM) and, while active, primarily functioned as an Army installation engaged in communications intelligence. VHFS is located approximately 40 miles southwest of Washington, D.C., in Fauquier County, Virginia, as shown on Figure 1. The installation occupies approximately 701 acres of land near the town of Warrenton, Virginia. Approximately 150 acres of the installation are improved grounds in the southern portion of the property used for industrial operations, administration buildings, and residential housing. Approximately 94 acres in the eastern portion of the property are mature hardwood forest, and the majority of the remaining 457 unimproved and semi-improved acres in the northern portion of the property are used for stationary and mobile antenna operation sites.

The facility was designated for closure in March, 1993, under the Base Realignment and Closure (BRAC) Act. Pursuant to the decision to close the installation, an Enhanced Preliminary Assessment (ENPA) and a Community Environmental Response Facilitation Act (CERFA) investigation of VHFS were conducted by Science Applications International Corporation (SAIC) to assess the environmental condition of the installation. The ENPA and CERFA investigations were completed in April and May, 1994, respectively. The ENPA identified 42 AREEs from the review of installation records, aerial photographs, installation personnel interviews, federal and state regulatory records, and visual inspection. Of these 42 AREEs, 27 were recommended for further investigation.

These 27 AREEs were investigated from September, 1994, to June, 1995, as part of the Site Inspection (SI) conducted by SAIC. The objective of the SI was to determine the presence or absence of contamination and the chemical nature of any detected contamination. The final SI Report, which was completed in June, 1996, identified 24 AREEs which required further investigation. In addition, four new AREEs were identified during site reconnaissance to warrant further investigation subsequent to the SI. AREEs that were determined to warrant further investigation and are located in the Phase II reuse area (shown on Figure 2) were investigated between February and April, 1997, as part of the Phase II reuse area Remedial Investigation (RI) conducted by ICF Kaiser Engineers, Inc. (ICF KE). The purposes of the RI were to evaluate: 1) the nature and extent of contamination; and 2) the level of risk posed to human health and the environment. The draft RI Report for the Phase II reuse area was completed in January, 1998, and is currently undergoing regulatory review.

Four AREEs were identified in the RI as having soil contamination which poses unacceptable human health risks and/or significant adverse ecological effects:

- AREE 2 - Sewage Treatment Plant;
- AREE 4 - Auto Craft Shop;
- AREE 28-5 - Former Service Station Abandoned Underground Storage Tanks (USTs); and
- AREE 31 - Construction Debris Pile #1.

The locations of these AREEs are shown on Figure 2.

RESULTS OF THE REMEDIAL INVESTIGATION

The RI for these four AREEs was conducted to evaluate the nature and extent of contamination associated with past site activities. Environmental samples collected and analyzed during the RI were used in conjunction with the results from the SI to assess the condition of each of the AREEs. The environmental media investigated included surface soil (0 to 2 feet below ground surface [bgs]),

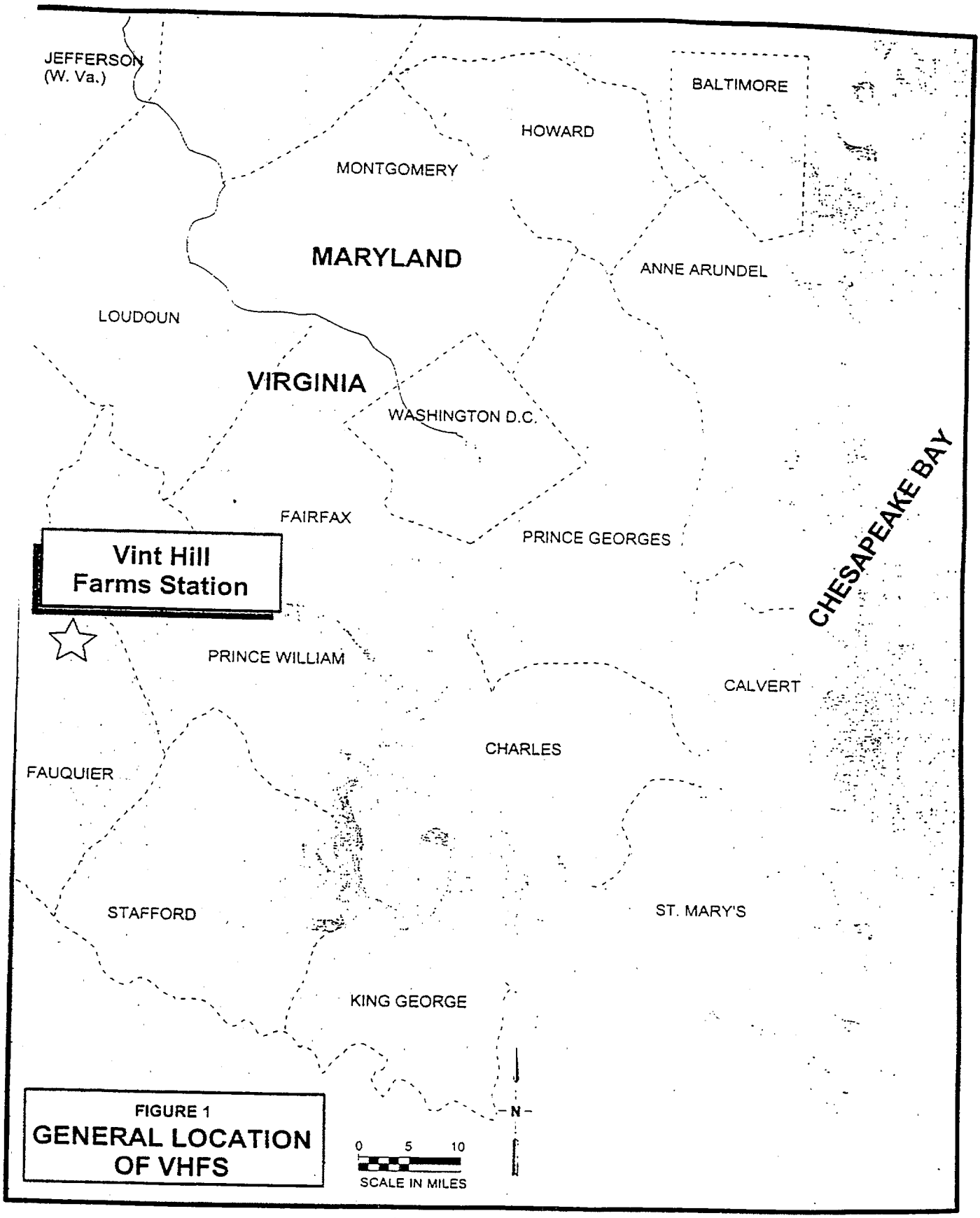


FIGURE 1
GENERAL LOCATION OF VHFS

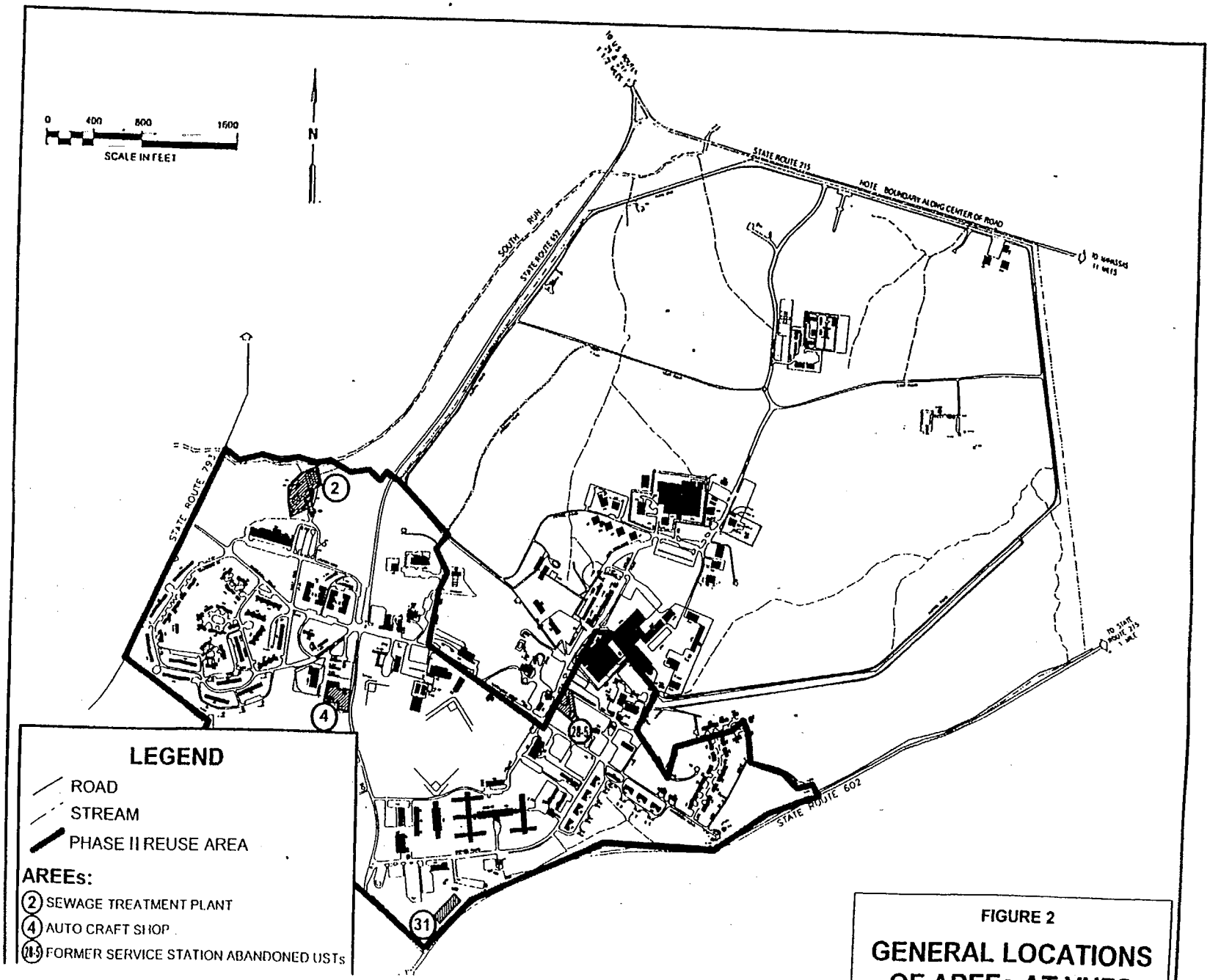


FIGURE 2

GENERAL LOCATIONS OF AREEs AT VHFS

subsurface soil (2 feet to approximately 10 feet bgs), surface water, sediment, and groundwater. Analytical results were compared to background concentrations and regulatory screening levels to determine if environmental media had been adversely impacted by site activities. A brief description of each of the four AREEs and the significant findings of the RI and SI are presented in the following paragraphs. A detailed presentation of the samples collected and the analytical results can be found in the draft Phase II Reuse Area RI Report, now available in the Information Repository at the Fauquier County Library.

AREE 2- Sewage Treatment Plant

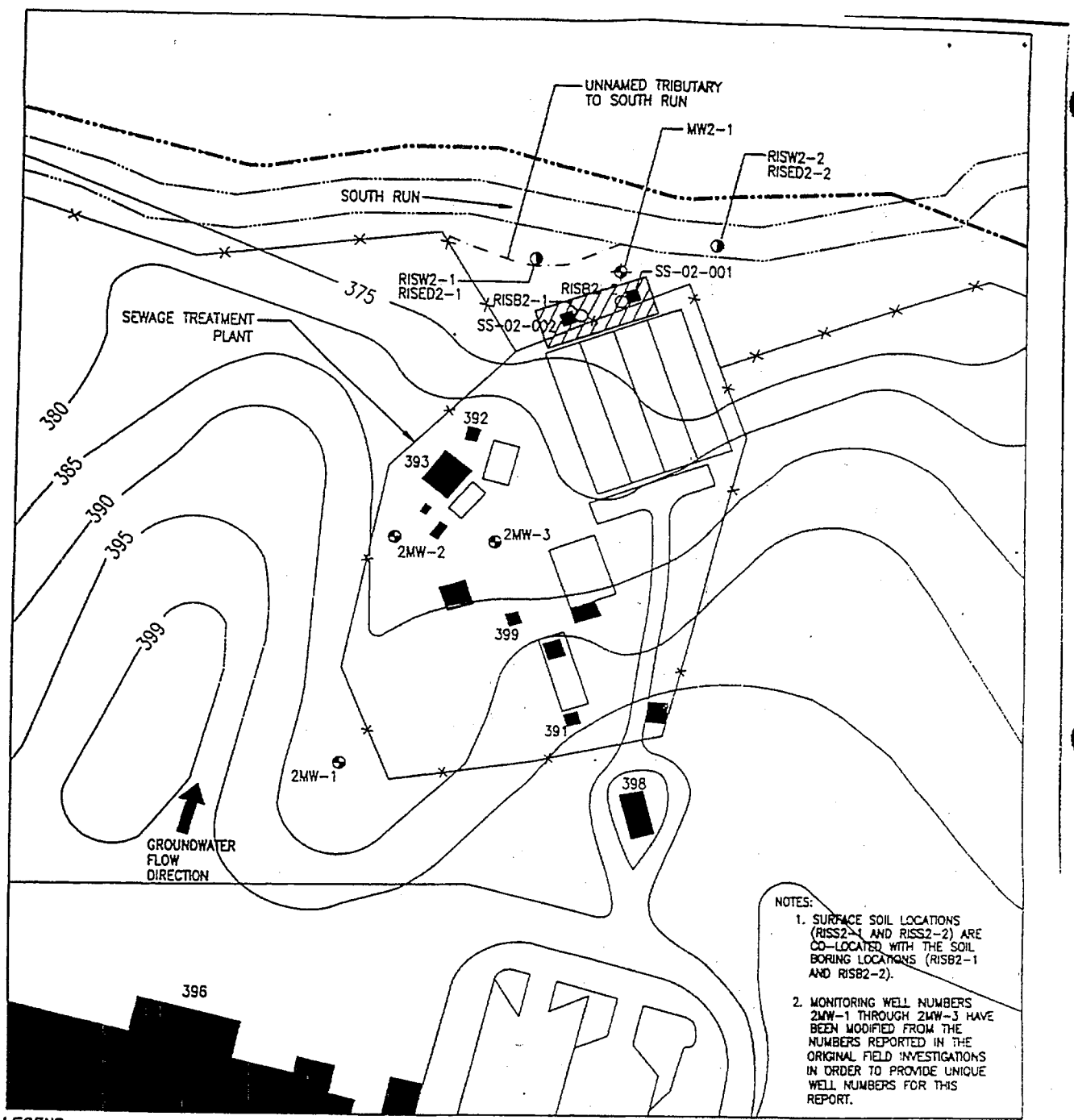
AREE 2 is the sewage treatment plant (STP) which serves approximately 70 VHFS permanent residents and 500 daily employees and has been in service since 1952. The plant has treated sanitary wastewater, industrial wastewater from VHFS operations (photographic, painting, laboratory, vehicle washing, and metal etching), and surface water runoff. The facility discharges treated effluent to South Run under a Virginia Pollutant Discharge Elimination System (VPDES) permit. Before 1980, sludge was stored in piles on the ground near South Run.

Surface soil, subsurface soil, sediment, surface water, and groundwater samples were collected at AREE 2 as shown on Figure 3. Metals were detected in surface soil above residential soil risk-based concentrations (RBCs) established by USEPA Region III for screening analytical results. Mercury (4.3 parts per million [ppm]) was detected above the residential soil RBC of 2.3 ppm in surface soil sample SS-02-002. Benzo(a)pyrene, a polynuclear aromatic hydrocarbon (PAH), was present above residential soil RBCs in one surface soil sample downgradient of the former sludge pile. Based on the results of the subsurface soil samples, subsurface soil has not been impacted by AREE 2 activities.

AREE 4 - Auto Craft Shop

The Auto Craft Shop (Building 306 and former Building 308) was used as the motor pool from 1943 to 1967, and as a vehicle maintenance area where military personnel performed maintenance on their private vehicles from 1968 to 1994. The buildings were used to store oil, solvents, and lubricants for vehicle maintenance activities as well as spent solvent and waste oil filters. The buildings have concrete floors with no curbs or floor drains. Gasoline and oil spills have been recorded in this area and were cleaned up using absorbents. A 1,000-gallon UST was used to store waste oil prior to its removal in July, 1990. A plume of petroleum contamination currently lies under the shop as a result of leaks from the UST. A corrective action for this plume has been implemented. Three areas where surface runoff/discharge from AREE 4 occurs have been identified (see Figure 4). An outdoor vehicle wash rack near former Building 308 drained into a grit chamber, which has been removed. The grit chamber was used to settle the solids prior to discharge of water from the vehicle wash rack via a ceramic pipe into the wooded area south of former Building 308. The floor of the grit chamber and the associated contaminated soil were removed during the Phase II reuse area RI field investigation. A storm sewer drain located west of Building 306 and former Building 308 discharged surface runoff to the field south of the Auto Craft Shop. Surface runoff also drains south of the Auto Craft Shop near the former hydraulic lift.

Surface soil, subsurface soil, and groundwater samples were collected at AREE 4 as shown on Figure 4. Total petroleum hydrocarbon (TPH) contamination, exceeding the Virginia TPH soil action level for USTs of 100 ppm, was present in surface soil samples collected near the storm sewer discharge area, former hydraulic lift surface runoff area, and wash rack discharge area. The maximum TPH concentration (1,860 ppm) was detected in surface soil sample SS-04-002 collected at the former hydraulic lift surface runoff area. Metals were detected in surface soil above residential soil RBCs at all three surface runoff/discharge areas. Lead contamination exceeding the USEPA screening level for lead in residential soil of 400 ppm was detected in surface soil at all three surface runoff/discharge areas. The maximum lead concentration (1,700 ppm) was detected in a surface soil sample collected from the storm sewer discharge area. Four PAHs (benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, and indeno[1,2,3-cd]pyrene) exceeding the residential soil RBCs are present in surface soil at the wash rack discharge area. Only benzo(a)pyrene is present in surface soil above the residential soil RBC (0.088 ppm) in all three surface runoff/discharge areas. The maximum benzo(a)pyrene concentration of 1.52 ppm was detected in surface soil sample RISS4-5



LEGEND:

- IMPACTED SURFACE SOIL AREA (APPROXIMATE)
- BUILDING
- VHFS BOUNDARY
- PAVED ROAD
- FENCE
- STREAM
- TRIBUTARY
- 380 TOPOGRAPHIC CONTOUR (FT MSL)
- SI SURFACE SOIL SAMPLE LOCATION
- EXISTING MONITORING WELL
- PHASE II RI MONITORING WELL
- PHASE II RI SOIL BORING LOCATION
- PHASE II RI SURFACE WATER/SEDIMENT SAMPLE LOCATION

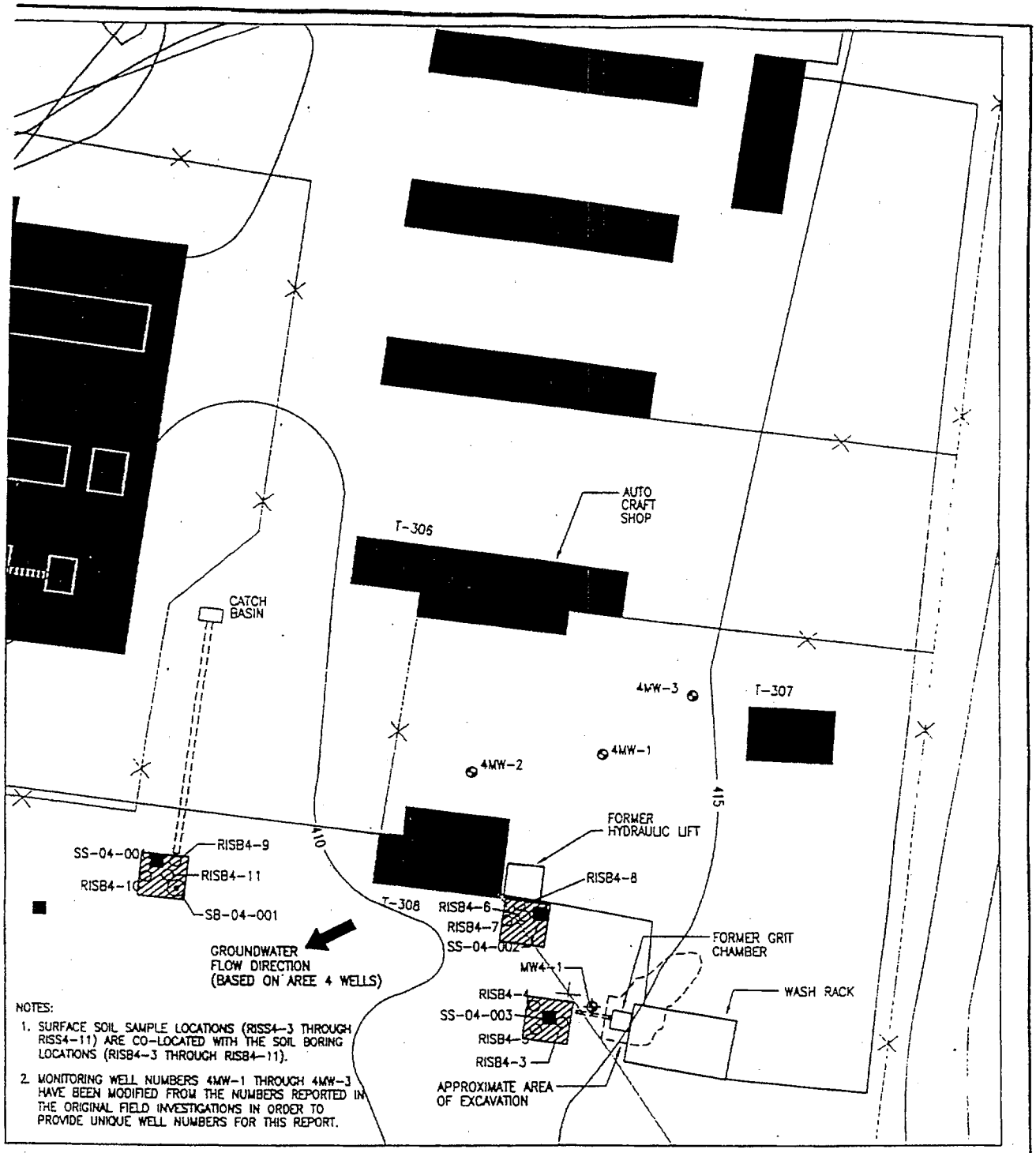
N

0 50 100

SCALE IN FEET

FIGURE 3

SI AND RI SAMPLE LOCATIONS FOR AREE 2 - SEWAGE TREATMENT PLANT



NOTES:

1. SURFACE SOIL SAMPLE LOCATIONS (RISS4-3 THROUGH RISS4-11) ARE CO-LOCATED WITH THE SOIL BORING LOCATIONS (RISB4-3 THROUGH RISB4-11).
2. MONITORING WELL NUMBERS 4MW-1 THROUGH 4MW-3 HAVE BEEN MODIFIED FROM THE NUMBERS REPORTED IN THE ORIGINAL FIELD INVESTIGATIONS IN ORDER TO PROVIDE UNIQUE WELL NUMBERS FOR THIS REPORT.

LEGEND:

- IMPACTED SURFACE SOIL AREA (APPROXIMATE)
- FENCE
- BUILDING
- ROAD
- STORM DRAIN
- 410 TOPOGRAPHIC CONTOUR (FT MSL)
- SI SOIL BORING LOCATION
- SI SURFACE SOIL SAMPLE LOCATION
- PHASE II RI SOIL BORING LOCATION
- EXISTING MONITORING WELL
- PHASE II RI MONITORING WELL

N

0 25 50

SCALE IN FEET

FIGURE 4

SI AND RI SAMPLE LOCATIONS FOR AREE 4 - AUTO CRAFT SHOP

located in the wash rack discharge area. Based on the results of the subsurface soil samples from the three surface runoff/discharge areas, subsurface soil has not been impacted by AREE 4 activities.

AREE 28-5 - Former Service Station Abandoned USTs

AREE 28-5 consists of the Former Service Station Abandoned USTs located under the asphalt parking lot approximately 60 ft northwest of the former service station (Building 220). Three 5,000-gallon steel USTs were used for the storage of gasoline and diesel fuel products. The USTs were approximately 30 years old and were in service until 1983. Environmental Restoration Company (ERC) removed the USTs and associated pipelines in December, 1994.

Subsurface soil and groundwater samples were collected at AREE 28-5 as shown on Figure 5. TPH contamination, exceeding the Virginia TPH soil action level for USTs of 100 ppm, was detected in subsurface soil in the vicinity of the former pump island at depths ranging from 2 ft bgs to at least 10 ft bgs. The maximum TPH concentration (5,273 ppm) was detected at a depth of 8-10 ft bgs in soil boring RISB28-5-1.

AREE 31 - Construction Debris Pile #1

AREE 31 is a construction debris pile located approximately 200 to 300 ft northwest of the southernmost tip of the VHFS property boundary in a predominantly wooded and vegetated area. The pile consists of construction debris including, but not limited to, concrete pipe, corrugated steel pipe, steel footers, antennae pillars, roofing paper, bricks, cinder blocks, cement slabs, and insulation material. The debris pile has an area of approximately 15 ft by 150 ft.

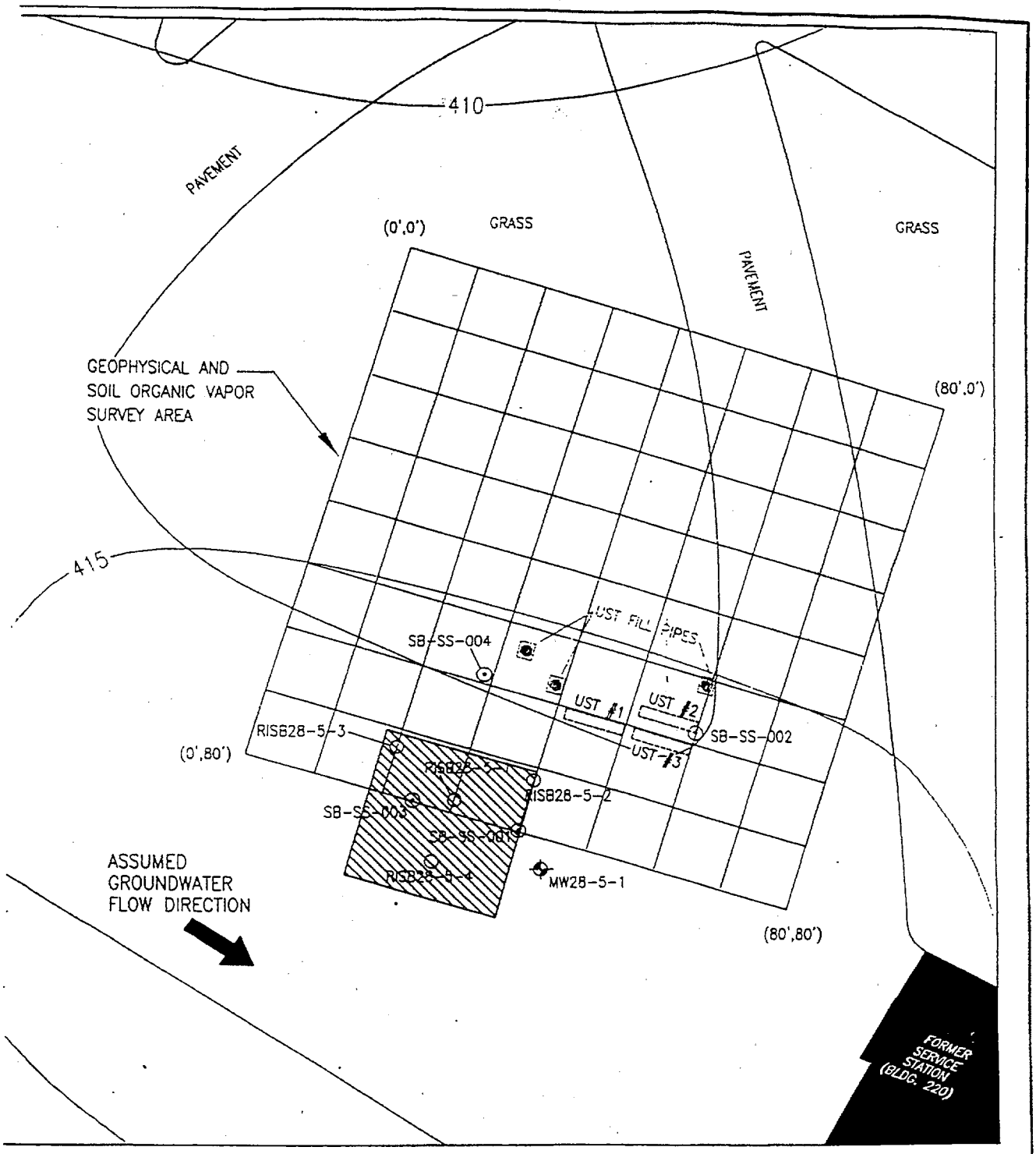
Surface and subsurface (from a test pit) soil samples were collected at AREE 31 as shown on Figure 6. Metals (cadmium, copper, and lead) and PAH contamination is present in surface soil sample RISS31-2. The lead concentration of 3,610 ppm exceeded the USEPA screening level for lead in residential soil of 400 ppm. Cadmium and copper concentrations of 7.59 ppm and 1,880 ppm exceeded their respective residential soil RBCs of 3.9 ppm and 310 ppm. Five PAHs (benzo[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[a]pyrene, and indeno[1,2,3-cd]pyrene) exceeded the residential soil RBCs by one or more orders of magnitude in surface soil sample RISS31-2. For example, benzo(a)pyrene was detected at 34.6 ppm compared to its residential soil RBC of 0.088 ppm. Subsurface soil has not been impacted by the debris present at AREE 31.

HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT

A Baseline Risk Assessment (BRA) was conducted as part of the RI to assess the human health and ecological problems that could result if the contamination at the AREEs was not remediated. The Human Health Risk Assessment (HHRA) was prepared to evaluate the magnitude of potential adverse effects on human health associated with current and potential future (assuming residential development of the property) exposures to site-related chemicals at the AREEs. The Ecological Risk Assessment (ERA) was conducted to characterize the potential threats to ecological receptors posed by contaminants at the AREEs.

The HHRA follows a four-step process:

- Selection of Chemicals of Potential Concern - identifies the contaminants of potential concern based on their toxicity, frequency of occurrence, and concentration by comparing the maximum concentrations of detected chemicals with RBCs which are health-protective chemical concentrations that are back-calculated using toxicity criteria, a $1x10^{-6}$ target carcinogenic risk or a 0.1 hazard quotient (defined below), and conservative exposure parameters;
- Exposure Assessment - identifies the potential pathways of exposure, and estimates the concentrations of contaminants to which people may be exposed as well as the frequency and duration of these exposures;
- Toxicity Assessment - determines the toxic effects of the contaminants; and
- Risk Characterization - provides a quantitative assessment of the overall current and future risk to people from site contaminants based on the exposure and toxicity information.



LEGEND:

- IMPACTED SOIL AREA (APPROXIMATE)
- BUILDING
- PAVED ROAD
- 410 TOPOGRAPHIC CONTOUR (FT MSL)
- UST FILL PIPE
- FORMER UST LOCATION
- SI SOIL BORING LOCATION
- PHASE II RI MONITORING WELL
- PHASE II RI SOIL BORING LOCATION

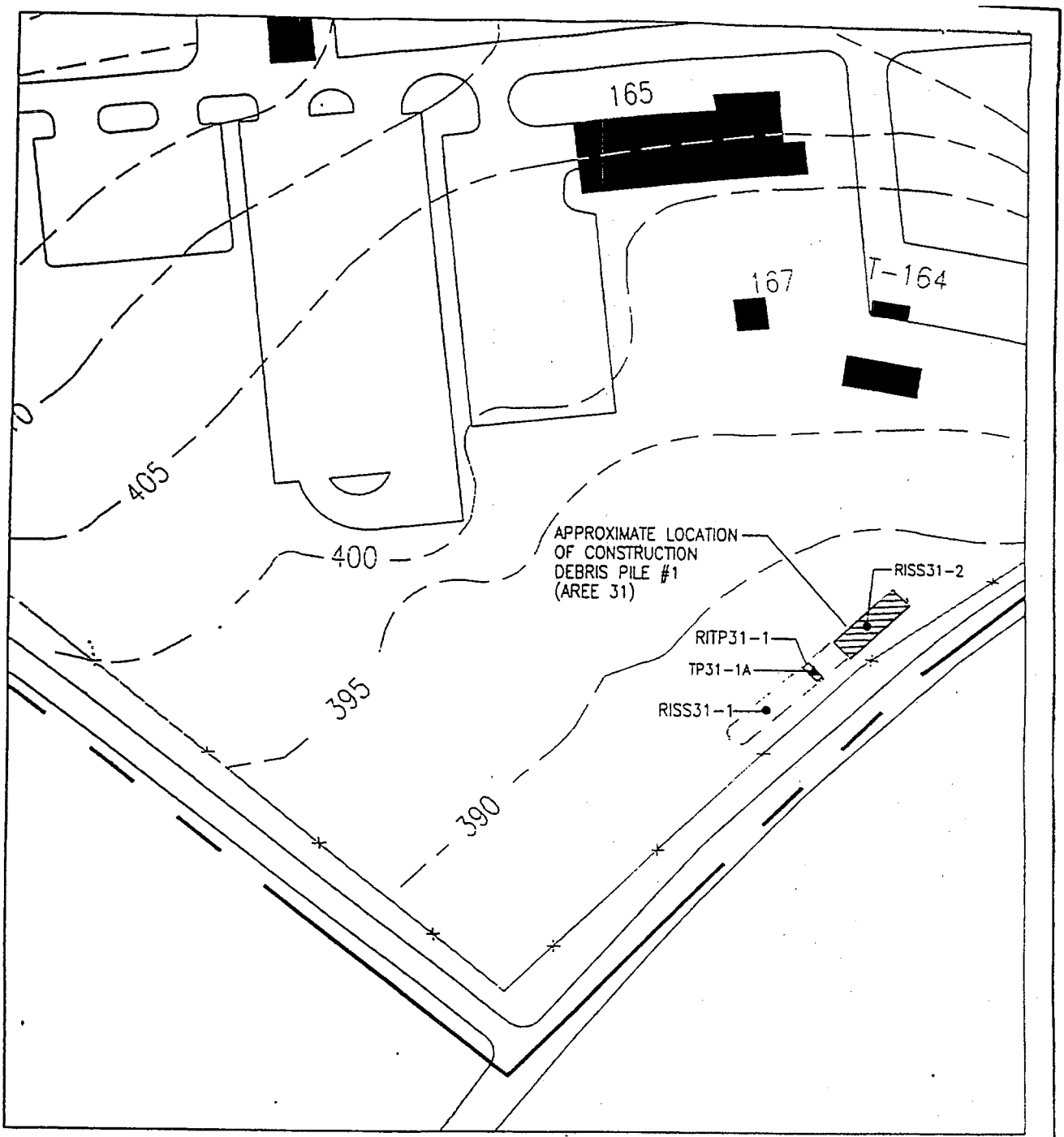
N

0 10 20

SCALE IN FEET

FIGURE 5

SI AND RI SAMPLE LOCATIONS FOR AREE 28-5 - FORMER SERVICE STATION USTs



LEGEND:

- IMPACTED SURFACE SOIL AREA (APPROXIMATE)
- BUILDING
- VHFS BOUNDARY
- PAVED ROAD
- FENCE
- 420 — TOPOGRAPHIC CONTOUR (FT MSL)
- PHASE II RI TEST PIT LOCATION
- PHASE II RI TEST PIT SAMPLE
- PHASE II RI SURFACE SOIL SAMPLE LOCATION

N

0 50 100

SCALE IN FEET

FIGURE 6
RI SAMPLE LOCATIONS FOR AREE 31 - CONSTRUCTION DEBRIS PILE #1

The HHRA evaluated health effects which could result from exposure to soil, groundwater, surface water, and sediment contamination in the Phase II reuse area of VHFS. The HHRA evaluated potential risks to current workers who could be exposed to contaminants in surface soil, and to current trespassers who could be exposed to contamination in surface soil, surface water, and sediment. In addition, the HHRA evaluated potential risks to hypothetical future adult residents who could be exposed to contaminants in groundwater and surface soil and to hypothetical future child residents who could be exposed to contaminants in groundwater, surface soil, surface water, and sediment. Potential risks to future excavation workers who could be exposed to contaminants in subsurface soil were also evaluated in the HHRA.

Potential carcinogenic (cancer-related) effects and noncarcinogenic effects (including various impacts on different organ systems, such as lungs, liver, etc.) were evaluated in the HHRA. Carcinogenic effects are expressed as the probability that an individual will develop cancer from exposure to the contaminants from each AREE. The evaluation of noncarcinogenic effects is based on the hazard index (HI), which is the summation of the hazard quotients for individual chemicals. The hazard quotient is a comparison of chemical-specific chronic exposure doses with the corresponding protective doses derived from health criteria. The USEPA recommends that remedial actions may be warranted at sites where the carcinogenic risk to any person is greater than $1x10^{-4}$ or the HI is greater than 1. A carcinogenic risk of $1x10^{-4}$ means that there is a potential of one additional person in a population of 10,000 developing cancer from exposure to contaminants at an AREE if the AREE is not remediated. A HI greater than 1 indicates a potential for noncarcinogenic health effects if the AREE is not remediated.

The ERA also follows a four-step process:

- Problem Formulation - develops information that characterizes habitats and potentially exposed species and identifies contaminants of concern, exposure pathways, and receptors;
- Exposure Assessment - estimates exposure point concentrations for selected indicator species;
- Ecotoxicologic Effects Assessment - identifies concentrations or doses of contaminants that are protective of indicator species; and
- Risk Characterization - estimates potential adverse effects from exposure to contaminants based on exposure and toxicity information.

The ERA evaluated ecological effects which could result from exposure to surface soil, surface water, and sediment contamination in the Phase II reuse area of VHFS. The ERA evaluated potential adverse ecological effects to terrestrial plants and terrestrial invertebrates (represented by earthworms) exposed to contaminants in surface soil. In addition, potential adverse ecological effects to mammals (represented by shrews) and birds (represented by robins) through bioaccumulation in the food web and exposure to contaminants in surface soil were evaluated. Potential adverse ecological effects to aquatic life from exposure to contaminants in surface water and sediment were also evaluated in the ERA. Further, the potential adverse ecological effects to mammals (represented by minks) and birds (represented by herons) through bioaccumulation in the food web and exposure to contaminants in sediment were evaluated.

The evaluation of significant potential adverse ecological effects is based on the Environmental Effects Quotient (EEQ). The EEQ is the ratio of the estimated exposure concentrations/doses for the chemicals of potential concern and the toxicity reference values (TRVs) for the ecological receptors. If the EEQ is greater than 1, there is a potential for adverse ecological effects to occur. As the magnitude of the EEQ becomes greater than 1, the potential for adverse ecological effects becomes more significant.

The results of the BRA for the four AREEs are presented in the following paragraphs. A detailed presentation of the BRA can be found in the draft Phase II Reuse Area RI Report, now available in the Information Repository at the Fauquier County Library.

AREE 2 - Sewage Treatment Plant

The HHRA determined that, under both current and future land-use conditions, the risks to workers, trespassers, residents, and excavation workers are acceptable for exposure to site-related contaminants at AREE 2. Discounting naturally-occurring metals that were statistically determined to be within background

concentrations, the highest estimated upper-bound excess lifetime cancer risk ($8X10^{-6}$) is for adult residents exposed to site-related contaminants in surface soil by dermal absorption, and the highest noncarcinogenic risk (HI=0.2) is for child residents exposed to site-related contaminants in surface soil by incidental ingestion.

The ERA determined that contaminants in surface soil at AREE 2 pose significant potential adverse ecological effects. The significant potential adverse ecological effects result primarily from mercury. Mercury results in significant potential adverse ecological effects for terrestrial plants, earthworms, robins, and shrews, with the greatest potential adverse ecological effects occurring to robins (EEQ of 3,500).

The mercury contamination downgradient of the former sludge pile is recommended for remediation. The impacted area has approximate dimensions of 75 ft by 25 ft by 2 ft deep, as shown on Figure 3.

AREE 4 - Auto Craft Shop

The HHRA concluded that, under both current and future land-use conditions, the risks to workers, trespassers, residents, and excavation workers are acceptable for exposure to site-related contaminants, except for lead, in soil at AREE 4. Discounting naturally-occurring metals that were statistically determined to be within background concentrations, the highest estimated upper-bound excess lifetime cancer risk ($5X10^{-5}$) is for adult residents exposed to site-related contaminants in surface soil by dermal absorption, and the highest noncarcinogenic risk (HI=0.3) is for child residents exposed to site-related contaminants in surface soil by dermal absorption.

The human health risks associated with exposure to lead contamination in surface soil at AREE 4 were evaluated using the Integrated Exposure Uptake Biokinetic (IEUBK) Model recommended by USEPA for evaluating lead exposures for young children in residential settings. The IEUBK Model calculates blood lead levels which result from exposures to lead which may then be compared to blood lead levels of toxicological significance for purposes of risk evaluation. The IEUBK Model run for AREE 4 predicted a geometric mean blood lead level of 6.9 µg/dL, with 19.81 percent of the population exceeding the blood lead level of concern (10 µg/dL). The USEPA currently finds 5 percent of the population exceeding the blood lead level of concern acceptable. Therefore, the IEUBK model results indicate that if AREE 4 was developed for residential use in the future, the lead concentrations in the surface soil may be a potential problem for young children.

The ERA determined that metals in surface soil at AREE 4 pose significant potential adverse ecological effects. The significant potential adverse ecological effects result primarily from lead, selenium, mercury, and zinc. Lead, selenium, and zinc result in significant potential adverse ecological effects to terrestrial plants with EEQs of 34, 38, and 15, respectively. Mercury results in significant potential adverse ecological effects to robins (EEQ of 210) and shrews (EEQ of 13).

The metals contamination in the surface soil at the three surface runoff/discharge areas is recommended for remediation. The approximate dimensions of the impacted area at each of the three surface runoff/discharge areas are 15 ft x 15 ft x 2 ft deep, as shown on Figure 4.

AREE 28-5 - Former Service Station Abandoned USTs

The ERA did not evaluate AREE 28-5 because this area is covered with asphalt, thus eliminating the potential for exposure to ecological receptors.

The HHRA determined that contamination at AREE 28-5 does not pose an unacceptable human health risk under either current or potential future land-use conditions. In fact, no chemicals of potential concern were identified in subsurface soil at AREE 28-5 in the HHRA. However, risks associated with exposures to TPH could not be assessed in the BRA because this analytical parameter represents a mixture of chemical constituents. Since TPH measurements give no indication of the chemical constituents present or their respective concentrations, they cannot be used to predict risks. Although risks associated with TPH cannot be estimated, TPH contamination in subsurface soil in the vicinity of the former pump island at AREE 28-5 exceeds the Virginia TPH soil action level for USTs and is, therefore, recommended for remediation. The impacted area is approximately 20 ft x 20 ft x 10 ft deep (minimum), as shown on Figure 5.

AREE 31 - Construction Debris Pile #1

The HHRA determined that, under current land-use conditions, the risks to workers are unacceptable for exposure to contaminants in surface soil at AREE 31. Under future land-use conditions, assuming that AREE 31 is not remediated, the risks to potential adult and child residents are also unacceptable for exposure to contaminants in surface soil at AREE 31. The highest estimated upper-bound excess lifetime cancer risk is for adult residents exposed to contaminants in surface soil by dermal absorption; this risk is $1x10^{-3}$ (i.e., 1 in 1,000 residents may develop cancer caused by exposure to contaminants in surface soil at AREE 31). Cancer risks were due primarily to exposures to benzo(a)pyrene and other PAHs. The highest noncarcinogenic risk is for child residents exposed to contaminants in surface soil by incidental ingestion; the HI is estimated to be 2, indicating that adverse effects could occur if child residents were exposed to contaminants in surface soil. The critical effect caused by exposure to noncarcinogenic contaminants in surface soil at AREE 31 is gastrointestinal irritation due to copper and iron (which was statistically determined to be within background concentrations). It should be noted that major uncertainties exist regarding the assessment of dermal absorption exposures (particularly associated with dermal absorption factors); therefore, estimated risks are likely to be over-estimated for the dermal absorption exposure route.

As explained in the AREE 4 discussion, lead contamination in surface soil at AREE 31 was evaluated using the IEUBK Model which predicted a geometric mean blood lead level of 15 µg/dL, with 78.4 percent of the population exceeding the blood lead level of concern (10 µg/dL). Again, the USEPA currently finds 5 percent of the population exceeding the blood lead level of concern acceptable. Therefore, the IEUBK Model results indicate that if AREE 31 was developed for residential use in the future, the lead concentrations in the surface soil may be a potential problem for young children.

The ERA determined that contaminants in surface soil at AREE 31 pose significant potential adverse ecological effects. The significant potential adverse ecological effects result primarily from metals (copper, lead, mercury, and selenium) and one PAH (benzo[a]pyrene). Mercury results in significant potential adverse ecological effects for robins and shrews, with the greatest potential adverse ecological effects occurring to robins (EEQ of 250). Copper results in significant potential adverse ecological effects for terrestrial plants and earthworms, with the greatest potential adverse ecological effects occurring to earthworms (EEQ of 38). Selenium and lead result in significant potential adverse ecological effects for terrestrial plants with EEQs of 25 and 72, respectively. Benzo(a)pyrene results in significant potential adverse effects to earthworms with an EEQ of 13.

The most significant contamination at AREE 31 is in surface soil in the vicinity of surface soil sample RISS31-2 located in the northeastern portion of the debris pile, which is recommended for remediation. The impacted area has approximate dimensions of 50 ft x 15 ft x 2 ft, as shown on Figure 6.

REMEDIAL ACTION OBJECTIVES

Remedial action objectives are specific goals to protect human health and the environment. The remedial action objective for the four AREEs is to minimize the potential for contaminated soil to pose unacceptable risks to human or ecological receptors.

CLEANUP LEVELS ESTABLISHED FOR THE PREFERRED ALTERNATIVE

USEPA has established soil cleanup levels for the contaminants that contribute to the unacceptable risk determination at each of the four AREEs. The soil cleanup levels are presented in Table 1. The soil cleanup level for AREE 2 is based on concentrations which are protective of ecological receptors (EEQ=10). The soil cleanup level for lead in surface soil at AREEs 4 and 31 is based on the USEPA screening level for lead in residential soil of 400 ppm. The soil cleanup levels for other metals at AREE4 are based on concentrations which are protective of ecological receptors. The soil cleanup level for AREE 28-5 is based on the Virginia TPH soil action level for USTs of 100 ppm. USEPA established the soil cleanup levels for PAHs at AREE 31 based on a $1X10^{-6}$ (one in 1,000,000 people) upper-bound excess lifetime cancer risk for the potential future

Table 1

Cleanup Levels Established for Soil at the Four AREEs

Constituents	Cleanup Levels (ppm)
AREE 2 – SEWAGE TREATMENT PLANT	
Mercury (Ecological risk)	0.192 (a)
AREE 4 – AUTO CRAFT SHOP	
Lead (Human Health & Ecological risk)	400 (d)
Mercury (Ecological risk)	0.534 (a)
Selenium (Ecological risk)	10 (a)
Zinc (Ecological risk) (c)	500 (a)
AREE 28-5 – FORMER SERVICE STATION ABANDONED USTs	
TPH	100 (e)
AREE 31 – CONSTRUCTION DEBRIS PILE #1	
Benzo(a)anthracene (Human Health risk)	0.87 (b)
Benzo(a)pyrene (Human Health & Ecological risk)	0.087 (b)
Benzo(b)fluoranthene (Human Health risk)	0.87 (b)
Benzo(k)fluoranthene (Human Health risk) (c)	8.7 (b)
Copper (Ecological risk)	500 (a)
Indeno(1,2,3-cd)pyrene (Human Health risk)	0.87 (b)
Lead (Human Health & Ecological risk)	400 (d)
Mercury (Ecological risk)	0.48 (a)
Selenium (Ecological risk)	10 (a)

TPH – total petroleum hydrocarbons

USTs – underground storage tanks

(a) Based on a concentration which is protective of ecological receptors (EEQ=10).

(b) Human health cleanup levels are based on a $1X10^{-6}$ upper-bound excess lifetime cancer risk for the potential future residential land-use scenario.

(c) These compounds contribute to but do not drive unacceptable risk.

(d) USEPA screening level for lead in residential soil.

(e) Virginia TPH soil action level for USTs.

residential use scenario. The soil cleanup levels for metals, other than lead, at AREE 31 are based on concentrations which are protective of ecological receptors.

SUMMARY OF REMEDIAL ALTERNATIVES

Two remedial alternatives were evaluated to address soil contamination at AREEs 2, 4, 28-5, and 31. The range of remedial alternatives considered was limited by the nature and extent of the contamination. Since the amount of soil requiring remediation is relatively small (approximately 400 cubic yards), it was not practical to consider active treatment or containment options in terms of cost-effectiveness and implementability. The following remedial alternatives were evaluated:

- Alternative 1 - No Action; and
- Alternative 2 - Soil Removal.

Alternative 1 - No Action

The National Contingency Plan (NCP) and CERCLA, as amended by the Superfund Amendments and Reauthorization Act (SARA), require that a No Action alternative be considered as a baseline for comparison to other alternatives. No action would be taken to address site contamination under this alternative. In accordance with Section 121 of CERCLA, each AREE would be reviewed at least once every five years to re-evaluate site conditions and to determine the need for remedial action to protect human health and the environment.

Alternative 2 - Soil Removal

Under this alternative, all contaminated soil exceeding the established cleanup levels would be excavated, transported off site by truck, and disposed using a combination of permitted off-site hazardous waste, construction debris, and/or municipal landfills or incinerators, as appropriate based on analytical results. Approximately 400 cubic yards of impacted soil would be excavated as part of this alternative, followed by confirmation sampling to assure adequate removal of all soil exceeding the cleanup levels. Upon completion of the soil excavation, disturbed areas would be backfilled, regraded, and either vegetatively stabilized or paved (AREE 28-5) . The five-year review does not apply to this alternative because hazardous substances above risk-based cleanup levels would not remain on site.

EVALUATION OF ALTERNATIVES

CERCLA requires a comparison of the alternatives using nine evaluation criteria: overall protection of human health and the environment; compliance with applicable or relevant and appropriate requirements (ARARs); long-term effectiveness and permanence; reduction of toxicity, mobility or volume through treatment; short-term effectiveness; implementability; cost; and regulator and community acceptance. The first two criteria are considered by USEPA to be threshold criteria which must be met by each alternative. The nine evaluation criteria are described below:

- Overall protection of human health and the environment addresses whether or not a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.
- Compliance with ARARs addresses whether or not a remedy will meet all of the applicable or relevant and appropriate requirements of other federal and state environmental statutes and requirements or provides grounds for invoking a waiver.
- Long-term effectiveness and permanence refers to the ability of a remedy to maintain reliable protection of human health over time, once cleanup goals have been met.

- Reduction of toxicity, mobility, or volume through treatment is the anticipated performance of the treatment technologies a remedy may employ.
- Short-term effectiveness addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period until cleanup goals are achieved.
- Implementability is the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement a particular option.
- Cost includes estimated capital and operation and maintenance costs, and net present worth costs.
- Regulator acceptance indicates whether, based on their review of the RI and Proposed Plan, the regulators (VDEQ and USEPA) concur, oppose, or have no comment on the preferred alternative at this present time.
- Community acceptance will be assessed in the Decision Document following a review of the public comments received on the RI and the Proposed Plan.

The comparative analysis of the alternatives was conducted based upon these evaluation criteria, and is described below.

Overall Protection of Human Health and the Environment

The no action alternative (Alternative 1) is not protective of human health or the environment because the risks to potential future residents and the potential adverse effects to ecological receptors remain unchanged, which is unacceptable. Therefore, the no action alternative was eliminated from further consideration and will not be discussed further.

Alternative 2 provides adequate protection of human health and the environment by removing contaminated soil, thereby eliminating the potential for exposure.

Compliance with ARARs

Alternative 2 has been designed to achieve or comply with ARARs. This alternative will satisfy the established cleanup levels since all soil that is contaminated above applicable cleanup levels will be removed. In addition, the removal and disposition of contaminated soil during implementation of Alternative 2 would be done in accordance with federal and Virginia solid and hazardous waste regulations. During soil excavation, Virginia Regulations for the Control and Abatement of Air Pollution may apply. Ambient air conditions would be monitored during excavation activities to assure acceptable air quality. As necessary based on the ambient air monitoring, water sprays would be used to keep dust levels down.

Long-term Effectiveness and Permanence

Alternative 2 would provide for the permanent removal of contaminated soil to a permitted off-site location designed to prevent contaminant migration and exposures to human and ecological receptors.

Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternative 2 provides reduction of contamination at the AREEs by removing contaminated soil. The toxicity and volume of the contaminated soil would not be affected by this alternative; however, the mobility of the contaminants would be reduced because the off-site disposal facilities used would be designed to prevent contaminant migration.

Because treatment of the contaminated soil at the AREEs was not found to be practicable due to the small volume of impacted soil, Alternative 2 does not satisfy the statutory preference for treatment as a principal element of the remedy.

Short-term Effectiveness

Alternative 2 is considered to be effective in the short term because the volume of soil to be excavated is relatively small and would result in limited negative impacts to human health or the environment. Dust exposure to workers and adjacent residents would be controlled during excavation activities by water sprays as needed. Prior to excavation operations, temporary erosion control structures would be installed to prevent entry of storm water into the soil excavation areas and prevent erosion and movement of soil from contaminated areas. Although truck traffic would be increased during implementation of Alternative 2, the implementation period (approximately one month) is short and the number of trucks per day would be less than 20.

Implementability

Alternative 2 is considered readily implementable . Licensed transporters and permitted disposal facilities are currently available.

Cost

The cost to implement Alternative 2 is estimated at $260,000.

Regulator Acceptance

VDEQ and USEPA are currently reviewing this Proposed Plan. VDEQ and USEPA comments will be addressed in the Decision Document.

Community Acceptance

Community acceptance of the preferred alternative will be evaluated at the close of the public comment period by considering both oral and written comments received during the public comment period.

PREFERRED ALTERNATIVE

Alternative 2, Soil Removal, is recommended by the U.S. Army as the preferred alternative for AREEs 2, 4, 28-5, and 31. This remedial alternative is a permanent solution that offers long-term effectiveness since the contaminated soil is removed to cleanup levels and transported off site for proper disposal. This remedial alternative would be designed to comply with ARARs. The excavation and disposal of contaminated soil would be done in accordance with federal and Virginia solid and hazardous waste regulations. The estimated cost to implement this alternative is $260,000, and the on-site activities would require approximately one month to complete.

The United States Army
at Vint Hill Farms Station, Virginia

Invites Public Comment

ON A PROPOSED ENVIRONMENTAL CLEANUP

Concerning Four Areas Requiring Environmental Evaluation: 2, 4, 28-5, & 31

Please Come To Our

♦ PUBLIC MEETING ♦

Thursday, April 9, 1998 ♦ 7:00 p.m.*

♦ Warrenton Middle School Auditorium ♦

244 Waterloo Street ♦ Warrenton, VA

(*Sign Language Interpreter will be present)

PURPOSE: TO DISCUSS AND PRESENT THE REMEDIAL ALTERNATIVES FOR THE SITES IDENTIFIED ABOVE.

The U.S. Army, in consultation with the U.S. Environmental Protection Agency (USEPA) Region III and the Virginia Department of Environmental Quality (VDEQ), invites public comment on its Proposed Plan for remediating contaminated soil at the following Areas Requiring Environmental Evaluation (AREEs) on Vint Hill Farms Station (VHFS), Virginia: AREE 2 – Sewage Treatment Plant; AREE 4 – Auto Craft Shop; AREE 28-5 – Former Service Station Abandoned Underground Storage Tanks; and AREE 31 – Construction Debris Pile #1. Before selecting a final remedy, VHFS will consider all written and oral comments received during the public comment period.

The U.S. Army will be accepting comments during a 30-day PUBLIC COMMENT PERIOD which begins Thursday, March 26, 1998 and ends Friday, April 24, 1998.

WRITTEN COMMENTS MAY BE SUBMITTED TO THE FOLLOWING ADDRESS:

Kevin Bell, Public Affairs Officer
Public Affairs Office (Bldg. 2500)

Thurs., April 9, 1998, 7:00 pm

- Educational Presentations
- Meet officials from USEPA, VDEQ and others
- Meet Citizen Members of the Restoration Advisory Board
- Question & Answer Session

PUBLIC INVOLVEMENT INFORMATION

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ATTACHMENT 2

CLEANUP LEVEL DEVELOPMENT DOCUMENTS

HUMAN HEALTH RISK-BASED REMEDIATION GOALS
AREAS REQUIRING ENVIRONMENTAL EVALUATION (AREEs) 4 AND 31
VINT HILL FARMS STATION (VHFS)

Risk-based remediation goals for VHFS based on human exposures at the site were calculated for selected chemicals detected in surface soil in areas proposed for remediation (i.e., surface soil at AREEs 4 [Auto Craft Shop] and 31 [Construction Debris Pile #1]). Based on a review of the exposure pathways evaluated in the risk assessment, risk-based remediation goals were calculated for chemicals contributing to pathway upper-bound excess lifetime cancer risks greater than $1x10^{-4}$ and/or hazard indices (HIs) greater than or equal to 1. The development of risk-based remediation goals focused on the incidental ingestion exposure pathway only. Risk-based remediation goals did not incorporate exposures through the dermal route of exposure due to the great uncertainties associated with assessing dermal exposures. For example, major uncertainties exist in the extent to which chemicals are percutaneously absorbed and in the extent to which chemicals partition from soil to skin leading to uncertainty in the use of default dermal absorption factors in the evaluation of risk. Uncertainties also exist in the use of adjusted oral toxicity criteria to evaluate dermal exposure pathways depending on how closely the factors used to adjust oral toxicity criteria reflect the difference between the oral and dermal routes.

In the VHFS human health risk assessment (HHRA), surface soil incidental ingestion pathways with upper-bound excess lifetime cancer risks greater than $1x10^{-4}$ and/or HIs greater than or equal to 1 were associated with adult and child resident exposures at AREE 31. In addition, the U.S. Environmental Protection Agency's (USEPA's) residential soil screening level for lead (USEPA, 1994) was exceeded at AREEs 4 and 31. The risk-based remediation goals for selected chemicals in surface soil were developed based on the more conservative residential receptor, consistent with USEPA Region III methodology for calculating risk-based concentrations (i.e., using combined child/adult residential exposure parameters for carcinogenic compounds and using child residential exposure parameters for noncarcinogenic compounds).

Risk-based remediation goals were calculated for carcinogenic chemicals associated with chemical-specific risks greater than or equal to $1x10^{-6}$ and noncarcinogenic chemicals contributing to a HI of 1 for a specific target organ. Risk-based remediation goals were not calculated for inorganic compounds that were statistically determined to be within background levels in the risk assessment. For selected carcinogenic chemicals, risk-based remediation goals were developed using a target risk level of $1x10^{-6}$, which is at the low end of USEPA's target risk range for health-protectiveness at Superfund sites. For selected noncarcinogenic chemicals, risk-based remediation goals were calculated to correspond to a target hazard quotient of 1. If any of the noncarcinogenic compounds for which remediation goals were calculated had similar target organs/critical effects, then the risk-based remediation goal for that noncarcinogenic compound was divided by the number of compounds having the same target organ/critical effect (i.e., if three noncarcinogenic compounds had "liver" as the target organ, the individual remediation goals would be divided by three). For chemicals that exhibit both carcinogenic and noncarcinogenic effects, the selected remediation goal represents the lower of the two calculated goals.

The following sections present the exposure assumptions and equations used to calculate the risk-based remediation goals for chemicals in surface soil. Table 1 presents the toxicity criteria used to calculate the risk-based remediation goals for chemicals in surface soil.

Surface Soil Risk-Based Remediation Goals

Risk-based remediation goals were calculated for chemicals in surface soil based on combined child/adult resident exposures for carcinogens and on child resident exposures for noncarcinogens for the incidental soil ingestion pathway. The equations and exposure assumptions used to calculate risk-based remediation goals for surface soil are presented below. Equations are presented separately for chemicals exhibiting carcinogenic and noncarcinogenic effects.

TABLE 1
CHRONIC ORAL TOXICITY CRITERIA

Chemical	Oral Toxicity Criteria for Carcinogens: Oral Slope Factor $(mg/kg\text{-}day)^{-1}$		Weight-of-Evidence Class (a)	Slope Factor Source	Oral Toxicity Criteria for Noncarcinogens: Chronic Oral Reference Dose (RfD) (mg/kg-day)	Uncertainty Factor (b)	Target Organ/ Critical Effect (c)	RfD Source
Organics								
Benzo(a)anthracene	7.3E-01	(d)	B2	IRIS	—	—	—	—
Benzo(a)pyrene	7.3E+00		B2	IRIS	—	—	—	—
Benzo(b)fluoranthene	7.3E-01	(d)	B2	IRIS	—	—	—	—
Benzo(k)fluoranthene	7.3E-02	(d)	B2	IRIS	—	—	—	—
Indeno(1,2,3-c,d)pyrene	7.3E-01	(d)	B2	IRIS	—	—	—	—
Inorganics								
Lead	—		B2	IRIS	—	—	CNS	IRIS

(a) USEPA weight-of-evidence classification scheme for carcinogens:
A = Human Carcinogen, sufficient evidence of carcinogenicity in humans;
B1 = Probable Human Carcinogen, limited human data are available;
B2 = Probable Human Carcinogen, sufficient evidence of carcinogenicity in animals with inadequate or lack of evidence in humans;
C = Possible Human Carcinogen, limited evidence from animal studies in the absence of human studies; and
D = Not classified as to human carcinogenicity, inadequate or no evidence.

(b) Uncertainty factors presented are the products of specific uncertainty factors and modifying factors. Uncertainty factors used to develop reference doses generally consist of multiples of 10, with each factor representing a specific area of uncertainty in the data available. The standard uncertainty factors include:
- a 10-fold factor to account for the variation in sensitivity among the members of the human population;
- a 10-fold factor to account for the uncertainty in extrapolating animal data to the case of humans;
- a 10-fold factor to account for the uncertainty in extrapolating from less-than-chronic NOAELs to chronic NOAELs; and
- a 10-fold factor to account for the uncertainty in extrapolating from LOAELs to NOAELs.

Modifying factors are applied at the discretion of the RfD reviewer to cover other uncertainties in the data and range from 1 to 10.

(c) A target organ or critical effect is the organ/effect most sensitive to the chemical exposure. RfDs are based on toxic effects in the target organ or critical effects. If an RfD is based on a study in which a target organ or critical effect was not identified, the organ/effect listed is one known to be affected by the chemical.

(d) The cancer slope factor for benzo(a)pyrene was used to evaluate carcinogenic PAHs, along with the toxic equivalency factor (TEF) approach. The TEFs used are as follows: benz(a)anthracene, 0.1; benzo(b)fluoranthene, 0.1; benzo(k)fluoranthene, 0.01; and indeno(1,2,3-c,d)pyrene, 0.1.

NOTE
IRIS = Integrated Risk Information System - USEPA,1997a.
— = No information available.
CNS = Central Nervous System.

The equation used to calculate risk-based remediation goals for chemicals exhibiting carcinogenic effects, using the combined child/adult exposure parameters based on USEPA (1991), is as follows:

$$C_s = \frac{TR * AT_c * 365\ days / year}{EF * IFA * SF_o * 10^{-6}\ kg / mg}$$

where:

C_s	=	chemical concentration in surface soil (mg/kg),
TR	=	target excess individual lifetime cancer risk (1×10^{-6}),
AT_c	=	averaging time for carcinogenic effects (70 years),
EF	=	exposure frequency (350 days/year),
IFA	=	adjusted integrated factor (see below) (114.3 mg-year/kg-day), and
SF_o	=	oral cancer slope factor [$(mg/kg\text{-}day)^{-1}$] (see Table 1).

The combined child/adult resident exposure parameters used to calculate carcinogenic risk-based remediation goals for incidental ingestion of surface soil incorporate an age-adjusted factor, which approximates the integrated exposure from birth until age 30 by combining contact rates, body weights, and exposure duration for both children and young adults (USEPA 1997b). The age-adjusted factor was calculated as follows, using exposure parameters from USEPA (1991):

$$IFA = \frac{ED_c * IR_c}{BW_c} + \frac{(ED_{tot} - ED_c) * IR_a}{BW_a}$$

where:

IFA	=	age-adjusted integrated factor (mg-year/kg-day),
ED_c	=	child's exposure duration (6 years),
IR_c	=	child's soil ingestion rate (200 mg/day),
BW_c	=	child's body weight (15 kg),
ED_{tot}	=	total exposure duration (30 years),
IR_a	=	adult's soil ingestion rate (100 mg/day), and
BW_a	=	adult's body weight (70 kg).

The equation used to calculate risk-based remediation goals for chemicals exhibiting noncarcinogenic effects, using the child exposure parameters obtained from USEPA (1991), is as follows:

$$C_s = \frac{THI * BW * AT_{nc} * 365\ days / year}{EF * ED * (1 / RfD_o) * 10^{-6}\ kg / mg * IR_{soil}}$$

where:

C_s	=	chemical concentration in soil (mg/kg),
THI	=	target hazard index (1),
BW	=	body weight (15 kg),
AT_{nc}	=	averaging time for noncarcinogenic effects (6 years),
EF	=	exposure frequency (350 days/year),
ED	=	exposure duration (6 years),
RfD_o	=	oral chronic reference dose (mg/kg-day) (see Table 1), and
IR_{soil}	=	soil ingestion rate (200 mg/day).

Summary of Risk-Based Remediation Goals

Risk-based remediation goals for AREEs 4 and 31 were calculated for selected chemicals in surface soil. Specifically, risk-based remediation goals were calculated for all chemicals associated with chemical-specific risks greater than or equal to $1x10^{-6}$ or chemicals contributing to a HI greater than or equal to 1 for a specific target organ for the incidental ingestion exposure pathway. Risk-based remediation goals were not calculated for inorganic compounds that were statistically determined to be within background levels. Risk-based remediation goals for all selected chemicals in surface soil were developed based on conservative child/adult resident receptors for carcinogens and child resident receptors for noncarcinogens. Risk-based remediation goals for surface soil are presented in Table 2.

Based on a review of the chemicals and pathways evaluated in the risk assessment, risk-based remediation goals for surface soil were calculated for: lead detected at AREE 4; and benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-c,d)pyrene, and lead detected at AREE 31. USEPA's residential soil screening level for lead was developed using the Integrated Exposure Uptake Biokinetic (IEUBK) model (USEPA, 1994) and is based on residential exposures by the most sensitive members of the population (i.e., young children). Since a risk-based remediation goal cannot be calculated for lead due to a lack of available quantitative carcinogenic and noncarcinogenic toxicity criteria, the 400 mg/kg residential soil screening level for lead is presented in Table 2 as the remediation goal for lead in surface soil.

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U.S. Environmental Protection Agency (USEPA). 1991. Risk Assessment Guidance for Superfund. Volume 1: Human Health Evaluation Manual Supplemental Guidance. Standard Default Exposure Factors. Interim Final. Washington, D.C. OSWER Directive 9285.6–03. March 25, 1991.

U.S. Environmental Protection Agency (USEPA). 1994. Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities. Memorandum to Regional Administrators from Elliot P. Laws, Assistant Administrator. Solid Waste and Emergency Response, OSWER Directive #9355.4-12. EPA/540/F-94/043.

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U.S. Environmental Protection Agency (USEPA). 1997b. Risk-Based Concentration Table. October 22, 1997.

TABLE 2
REMEDIATION GOALS FOR CHEMICALS IN SURFACE SOIL (a)

emical	Toxicity Criterion		Calculated Remediation Goal (mg/kg)		Selected Remediation Goal (mg/kg) (d)
	Carcinogenic (mg/kg-day)$^{-1}$	Noncarcinogenic (mg/kg-day)	Carcinogenic (b)	Noncarcinogenic (c)	
EE 4					
Resident Ingestion					
Lead	—	—	—	—	400 (e)
EE 31					
Resident Ingestion					
Benzo(a)anthracene	7.3E-01	—	0.87	—	0.87
Benzo(a)pyrene	7.3E+00	—	0.087	—	0.087
Benzo(b)fluoranthene	7.3E-01	—	0.87	—	0.87
Benzo(k)fluoranthene	7.3E-02	—	8.7	—	8.7
Indeno(1,2,3-c,d)pyrene	7.3E-01	—	0.87	—	0.87
Lead	—	—	—	—	400 (e)

Remediation goals were calculated for predominant chemicals (i.e., chemicals with risks exceeding $1x10^{-6}$ or chemicals contributing to a HI greater than or equal to 1 for a specific target organ) for the incidental ingestion pathways associated with a total excess lifetime cancer risk exceeding $1x10^{-4}$ or a HI greater than or equal to 1.

The calculated remediation goals for carcinogenic chemicals were based on a target risk level of $1x10^{-6}$ and were calculated using combined child/adult exposure parameters.

The calculated remediation goals for noncarcinogenic chemicals were calculated using child resident exposure parameters and were based on a hazard quotient of 1.

) The selected remediation goal represents the lower of the calculated carcinogenic and noncarcinogenic remediation goals.

) The selected remediation goal is USEPA's residential soil screening level for lead (USEPA, 1994).

ECOLOGICALLY-BASED CLEANUP LEVELS
AREAS REQUIRING ENVIRONMENTAL EVALUATION (AREEs) 2, 4, AND 31
VINT HILL FARMS STATION (VHFS)

Results of the Ecological Risk Assessment (ERA) conducted as part of the Phase II Reuse Area Remedial Investigation (RI) at VHFS (USACE, 1998) indicate the potential for adverse effects to ecological resources at several on-site locations. Surface soils at AREEs 2, 4, and 31 were identified as having the greatest potential to adversely affect ecological resources and were selected for remediation. The following ecological receptors were identified as having the greatest potential to be adversely affected in each of these areas:

- AREE 2 (Sewage Treatment Plant)
  - Terrestrial plants from the presence of mercury in surface soil;
  - Earthworms from the presence of mercury in surface soil; and
  - Robins and shrews from the presence of mercury in surface soil.
- AREE 4 (Auto Craft Shop)
  - Terrestrial plants from the presence of lead, selenium, and zinc in surface soil; and
  - Robins and shrews from the presence of mercury in surface soil.
- AREE 31 (Construction Debris Pile #1)
  - Terrestrial plants from the presence of copper, lead, and selenium in surface soil;
  - Earthworms from the presence of benzo(a)pyrene and copper in surface soil; and
  - Robins and shrews from the presence of mercury in surface soil.

The objective of this document is to identify the reduction in chemical concentrations necessary to be protective of these ecological resources. Because of the conservative nature of the toxicological values and exposure estimates, cleanup levels were derived based on an EEQ[1] of 10. The following sections derive cleanup levels for each of these areas based on the ecological resources at risk.

AREE 2 (Sewage Treatment Plant)

Terrestrial Plants

Results of the ERA indicate the potential for adverse effects to terrestrial plants from the presence of mercury in surface soil at AREE 2. A literature-based toxicity value of 0.3 mg/kg, derived by Will and Suter (1995a) and used in the ERA to evaluate the potential for adverse effects to terrestrial plants, was used to derive the cleanup level for mercury in surface soil. Using this toxicity value and a target EEQ of 10, the cleanup level for mercury in surface soil for terrestrial plants at AREE 2 is 3 mg/kg.

[1]The Environmental Effects Quotient (EEQ) is the ratio of the estimated exposure concentration/dose for the chemical of concern and the toxicity reference value (TRV) for the ecological receptor of concern.

Earthworms

Results of the ERA indicate the potential for adverse effects to earthworms from the presence of mercury in surface soil at AREE 2. A literature-based toxicity value of 0.1 mg/kg, derived by Will and Suter (1995b) and used in the ERA to evaluate the potential for adverse effects to earthworms, was used to derive the cleanup level for mercury in surface soil. Using this toxicity value and a target EEQ of 10, the cleanup level for mercury in surface soil for earthworms at AREE 2 is 1 mg/kg.

Terrestrial Wildlife

Results of the ERA indicate the potential for adverse effects to robins and shrews from the presence of mercury in surface soil at AREE 2. Attachment A outlines the screening model and input parameters used in the ERA to estimate the potential for adverse effects to robins and shrews. Assumptions in this model were designed to provide a highly conservative estimate of the potential for adverse effects to robins and shrews. In the model, it is assumed that robins and shrews would be exposed to the estimated average mercury concentrations detected at AREE 2 (2.79 mg/kg). However, as discussed in the RI, samples were biased to areas of likely contamination, and samples from these areas are likely to over-estimate actual levels of contamination throughout the facility. Further, the highest mercury concentrations were detected within a very localized area of AREE 2. The area of mercury contamination in surface soil at AREE 2 is immediately downgradient of the former sludge pile, and is estimated to be approximately 75 feet by 25 feet in size. Accordingly, robins and shrews are likely to be exposed to mercury in only a limited proportion of their total foraging area and, because of the biased sampling methodology, using an average of the mercury concentrations detected in surface soil at AREE 2 will likely over-estimate the potential for exposure and adverse effects.

Cleanup levels were determined by backcalculating through the risk model used in the ERA. Two approaches were used to develop cleanup levels for robins and shrews. The first approach assumes the foraging range of robins and shrews falls entirely in the contaminated areas of AREE 2. This approach is consistent with that used in the ERA and simply requires determining, by backcalculating through the equations presented in Attachment A, an average exposure concentration which is equal to 10 times the toxicity value[2] used in the ERA (i.e., an EEQ of 10). However, this approach is likely to over-estimate risks because it assumes the average AREE 2 exposure concentration, estimated by averaging the concentrations of chemical detected at surface soil sample locations, is an accurate indicator of chemical concentrations throughout the receptor's foraging range. The second approach applies a spatial factor to adjust for the area of actual contamination. This latter approach is expected to provide a more realistic estimate of exposure.

The spatial factor used for the second approach was derived by first estimating the total area over which a robin or shrew is likely to forage. Pitts (1984) estimated an average territory size of 0.42 hectares (equal to 45,208 square feet) for robins on a college campus in Tennessee. Meanwhile, Buckner (1966) estimated an average territory size of 0.39 hectares (equal to 41,978 square feet) for shrews. Cleanup levels for AREE 2 were calculated assuming robins and shrews would not be exposed to mercury at any location outside of AREE 2. This assumption was made because mercury was not detected at any other locations within the foraging range of these species.

The total area of potential mercury contamination to which a robin or shrew foraging at AREE 2 could be exposed was estimated to be 1,875 square feet by assuming a maximum area of contamination in AREE 2 of 75 feet by 25 feet. The proportion of the total foraging area at which a robin or shrew associated with AREE 2 could be exposed to mercury was then estimated by dividing the estimated total area contaminated with mercury by each species' estimated territory size. Using this approach, a proportion of 0.041 was

[2] The toxicity values used in the ERA are based on no observed adverse effects levels (NOAELs) derived by Oak Ridge National Laboratory (ORNL, 1996).

estimated for robin and a proportion of 0.045 was estimated for shrew. This proportion was then used as a multiplier in equations (2) and (5) of Attachment A.

Cleanup levels derived using the approaches described above are presented in Table 1. The approach which accounts for the limited distribution of mercury in the territorial range of robins and shrews results in higher cleanup levels. However, these cleanup levels are expected to be more realistic and are recommended for use as the final cleanup levels. Consistent with the ERA, cleanup levels were also derived for both inorganic and organic mercury (methylmercury). Although it is likely only a proportion of the mercury detected in surface soil is present in the organic form, it is recommended that the more conservative methylmercury cleanup level be selected as the cleanup level for AREE 2.

AREE 4 (Auto Craft Shop)

Terrestrial Plants

Results of the ERA indicate the potential for adverse effects to terrestrial plants from the presence of lead, selenium, and zinc in surface soil. Literature-based toxicity values for lead, selenium, and zinc of 50 mg/kg, 1 mg/kg, and 50 mg/kg, respectively, derived by Will and Suter (1995a) were used in the ERA to evaluate the potential for adverse effects to terrestrial plants. Using these toxicity values and a target EEQ of 10, the cleanup levels for lead, selenium, and zinc in surface soil for terrestrial plants at AREE 4 are 500 mg/kg, 10 mg/kg, and 500 mg/kg, respectively.

Terrestrial Wildlife

Results of the ERA indicate the potential for adverse effects to robins and shrews from the presence of mercury in surface soil at AREE 4. Attachment A outlines the screening model and input parameters used in the ERA to estimate the potential for adverse effects to robins and shrews. Assumptions in this model were designed to provide a highly conservative estimate of the potential for adverse effects to robins and shrews. In the model, it is assumed that robins and shrews would be exposed to the average of the mercury concentrations detected at AREE 4 (0.167 mg/kg). However, as discussed in the RI, the elevated mercury concentrations were detected in very localized areas at AREE 4. The areas of mercury contamination driving the risk to terrestrial wildlife are comprised of the runoff areas from the storm sewer discharge, the former hydraulic lift, and the wash rack discharge. Each of the areas of mercury contamination are estimated to be no greater than 15 feet by 15 feet in size. Accordingly, robins and shrews are likely to be exposed to this chemical in only a very limited proportion of their total foraging area, and the use of an average AREE 4 mercury concentration will likely over-estimate the potential for exposure and adverse effects to robins and shrews.

Cleanup levels for mercury were calculated for AREE 4 using the same methods described earlier to derive cleanup levels for mercury at AREE 2. The contaminated proportion of the total territory size was estimated to be 0.015 for robins and 0.016 for shrews assuming the contaminated area of AREE 4 is 675 square feet in size. Only AREE 4 was factored into the calculation because mercury was not detected at any other locations within the foraging range of these species. The cleanup levels derived for mercury are summarized in Table 1. It is recommended that the cleanup level derived using the approach which accounts for the spatial distribution of mercury be used as the cleanup level for AREE 4. Although it is likely only a proportion of the mercury detected in surface soil is present in the organic form, it is recommended that the more conservative methylmercury cleanup level be selected as the cleanup level for AREE 4.

Table 1
Surface Soil Cleanup Levels for the Protection of Terrestrial Wildlife
(Concentrations in mg/kg)

Analyte	Robin		Shrew	
	Cleanup Levels Based on Average AREE Concentrations	Cleanup Levels Based on Spatially-Adjusted Estimate of Contamination	Cleanup Levels Based on Average AREE Concentrations	Cleanup Levels Based on Spatially-Adjusted Estimate of Contamination
AREE 2 – SEWAGE TREATMENT PLANT				
Mercury (inorganic)	10.7	259	117	2,620
Methylmercury	0.008	0.192	0.132	2.95
AREE 4 – AUTO CRAFT SHOP				
Mercury (inorganic)	10.7	718	117	7,275
Methylmercury	0.008	0.534	0.132	8.20
AREE 31 – CONSTRUCTION DEBRIS PILE #1				
Mercury (inorganic)	10.7	645	117	6,550
Methylmercury	0.008	0.48	0.132	7.40

AREE 31 (Construction Debris Pile #1)

Terrestrial Plants

Results of the ERA indicate the potential for adverse effects to terrestrial plants from the presence of copper, lead, and selenium in surface soil. Literature-based toxicity values for copper, lead, and selenium of 100 mg/kg, 50 mg/kg, and 1 mg/kg, respectively, derived by Will and Suter (1995a) were used in the ERA to evaluate the potential for adverse effects to terrestrial plants. Using these toxicity values and a target EEQ of 10, the cleanup levels for copper, lead, and selenium in surface soil for terrestrial plants at AREE 31 are 1,000 mg/kg, 500 mg/kg, and 10 mg/kg, respectively.

Earthworms

Results of the ERA indicate the potential for adverse effects to earthworms from the presence of benzo(a)pyrene and copper in surface soil. Literature-based toxicity values for benzo(a)pyrene and copper of 2.57 mg/kg and 50 mg/kg, respectively, derived by Achazi et al. (1995, as cited in van Brummelen et al., 1996) and Will and Suter (1995b) were used in the ERA to evaluate the potential for adverse effects to earthworms. Using these toxicity values and a target EEQ of 10, the cleanup levels for benzo(a)pyrene and copper in surface soil for earthworms at AREE 31 are 25.7 mg/kg and 500 mg/kg, respectively.

Terrestrial Wildlife

Results of the ERA indicate the potential for adverse effects to robins and shrews from the presence of mercury in surface soil at AREE 31. Attachment A outlines the screening model and input parameters used in the ERA to estimate the potential for adverse effects to robins and shrews. Assumptions in this model were designed to provide a highly conservative estimate of the potential for adverse effects to robins and shrews. In the model, it is assumed that robins and shrews would be exposed to the average of the mercury concentrations detected at AREE 31 (0.198 mg/kg). However, as discussed in the RI, elevated mercury concentrations were detected in a very localized area of AREE 31. The area of mercury contamination in surface soil that is driving the risk to terrestrial wildlife is the northeastern portion of the debris pile, which is estimated to be no greater than 15 feet by 50 feet in size. Accordingly, robins and shrews are likely to be exposed to this chemical in only a very limited proportion of their total foraging area, and the use of an average AREE 31 mercury concentration will likely over-estimate the potential for exposure and adverse effects to robins and shrews.

Cleanup levels for mercury were calculated for AREE 31 using the methods described earlier to derive cleanup levels for mercury at AREEs 2 and 4. The contaminated proportion of the total territory size was estimated to be 0.017 for robins and 0.018 for shrews assuming the contaminated area of AREE 31 is 750 square feet in size. Only AREE 31 was factored into the calculation because mercury was not detected at any other locations within the foraging range of these species. The cleanup levels derived for mercury are summarized in Table 1. It is recommended that the cleanup level derived using the approach which accounts for the spatial distribution of mercury be used as the cleanup level for AREE 31. Although it is likely only a proportion of the mercury detected in surface soil is present in the organic form, it is recommended that the more conservative methylmercury cleanup level be selected as the cleanup level for AREE 31.

Summary of Cleanup Levels

Table 2 presents the cleanup levels for chemicals of significant ecological concern in surface soil for AREEs 2, 4, and 31. For chemicals that pose potential adverse ecological effects to more than one receptor, the cleanup level presented in Table 2 is for the most sensitive receptor. It should be noted that the recommended cleanup level derived for mercury at AREEs 4 (0.53 mg/kg) and 31 (0.48 mg/kg) are higher than the maximum detected concentrations in these AREEs (i.e., 0.393 mg/kg at AREE 4, and 0.208 mg/kg

Table 2
Cleanup Levels for Chemicals in Surface Soil

Chemical	Cleanup Level (mg/kg)
AREE 2	
Mercury	0.192
AREE 4	
Lead	500
Mercury	0.534
Selenium	10
Zinc	500
AREE 31	
Benzo(a)pyrene	25.7
Copper	500
Lead	500
Mercury	0.48
Selenium	10

at AREE 31), indicating that remediation of mercury at these AREEs may not be required when its areal extent is considered.

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ATTACHMENT A
ESTIMATION OF ROBIN AND SHREW EXPOSURE TO CHEMICALS FOR THE DERIVATION OF CLEANUP LEVELS

The following sections present the methods used to calculate the potential ingestion of chemicals by robins and shrews from the ingestion of food (i.e., earthworms) and surface soil. The equations given below were derived based on equations presented by USEPA (1989). Table A-1 presents specific exposure parameter values used in these equations.

Total Dose

The total dietary exposure levels for robins and shrews to chemicals was determined using the following equation:

$$Dose_{total} = Dose_{worm} + Dose_{soil} \quad (1)$$

where:

$Dose_{worm}$ = amount of chemical ingested per day via ingestion of earthworms (in mg/kg bw-d, use equations 2, 3, and 4 to calculate); and

$Dose_{soil}$ = amount of chemical ingested per day from soil (in mg/kg bw-d, use equation 5 to calculate).

Dose From Earthworms

The following equation was used to calculate the dose of chemicals that robins and shrews would be expected to obtain from the ingestion of earthworms:

$$Dose_{worm} = FI * C_{diet} \quad (2)$$

where:

FI = food ingestion rate (kg/kg bw-d); and

C_{diet} = estimated chemical concentration in diet (in mg/kg, use equation 3 to calculate).

The estimated dietary concentration (C_{diet}) was calculated using the following equation:

$$C_{diet} = P_e * C_e \quad (3)$$

where:

P_e = proportion of diet consisting of earthworms (unitless); and

C_e = estimated concentration of chemical in earthworms (in mg/kg, use equation 4 to calculate).

Table A-1
Summary of Exposure Parameters Used in the Robin and Shrew Food Ingestion Models

Parameter	Robin Value	Shrew Value
Food ingestion rate (FI; kg/kg bw-d)	1.52 (a)	0.62 (g)
Proportion of diet consisting of earthworms (Pe; unitless)	0.18 (b,c)	0.314 (h)
Bioconcentration factor for chemical in earthworms (BCF; unitless)	inorganic mercury = 0.96 (d) methylmercury = 27 (e)	inorganic mercury = 0.96 (d) methylmercury = 27 (e)
Soil ingestion rate (SI; kg/kg bw-d)	0.158 (f)	0.058 (f)

(a) Hazelton et al. (1984) as cited in USEPA (1993).
(b) Wheelwright (1986) as cited in USEPA (1993).
(c) Howell (1942) as cited in USEPA (1993).
(d) Beyer and Stafford (1993).
(e) Eisler (1987).
(f) Beyer et al. (1994).
(g) Morrison et al. (1957) as cited in USEPA (1993).
(h) Whitaker and Ferraro (1963) as cited in USEPA (1993).

The concentration of chemical in an earthworm (C_e) as fresh weight was determined using the following equation:

$$C_e = C_{soil} * BCF \quad (4)$$

where:

C_{soil}	=	average concentration of chemical detected in surface soil (mg/kg); and
BCF	=	bioconcentration factor for chemical in earthworms (unitless).

Dose From Soil

The following equation was used to calculate the dose of chemicals that robins and shrews would be expected to obtain from the ingestion of surface soil:

$$Dose_{soil} = SI * C_{soil} \quad (5)$$

where:

SI	=	soil ingestion rate (kg/kg bw-d); and
C_{soil}	=	average chemical concentration in surface soil (mg/kg).

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ATTACHMENT 3

PUBLIC NOTICE

The United States Army at Vint Hill Farms Station, Virginia

Invites Public Comment

ON A PROPOSED ENVIRONMENTAL CLEANUP Concerning Four Areas Requiring Environmental Evaluation: 2, 4, 28-5, & 31

Please Come To Our

♦ PUBLIC MEETING ♦

Thursday, April 9, 1998 ♦ 7:00 p.m.*

♦ Warrenton Middle School Auditorium ♦

244 Waterloo Street ♦ Warrenton, VA

(*Sign Language Interpreter will be present)

PURPOSE: TO DISCUSS AND PRESENT THE REMEDIAL ALTERNATIVES FOR THE SITES IDENTIFIED ABOVE.

The U.S. Army, in consultation with the U.S. Environmental Protection Agency (USEPA) Region III and the Virginia Department of Environmental Quality (VDEQ), invites public comment on its Proposed Plan for remediating contaminated soil at the following Areas Requiring Environmental Evaluation (AREEs) on Vint Hill Farms Station (VHFS), Virginia: AREE 2 – Sewage Treatment Plant; AREE 4 – Auto Craft Shop; AREE 28-5 – Former Service Station Abandoned Underground Storage Tanks; and AREE 31 – Construction Debris Pile #1. Before selecting a final remedy, VHFS will consider all written and oral comments received during the public comment period.

The U.S. Army will be accepting comments during a 30-day PUBLIC COMMENT PERIOD which begins Thursday, March 26, 1998, and closes Friday, April 24, 1998.

WRITTEN COMMENTS MAY BE SUBMITTED TO THE FOLLOWING ADDRESS:

Kevin Bell, Public Affairs Officer,
Public Affairs Office (Bldg. 2500)
Vint Hill Farms Station,
Warrenton, VA 20187-5001

BACKGROUND

VHFS is part of the U.S. Army Communications - Electronics Command (CECOM) and, while active, primarily functioned as an Army installation engaged in communications intelligence. VHFS is located approximately 40 miles southwest of Washington, D.C., in Fauquier County, Virginia. The installation occupies approximately 701 acres of land near the town of Warrenton, Virginia. Approximately 150 acres of the installation are improved grounds in the southern portion of the property used for industrial operations, administration buildings, and residential housing. Approximately 94 acres on the eastern portion of the property are mature hardwood forest, and the majority of the remaining 457 unimproved and semi-improved acres in the northern portion of the property are used for stationary and mobile antenna operation sites. The facility was designated for closure in March, 1993, under the Base Realignment and Closure (BRAC) Act.

PROPOSAL

VHFS evaluated two remedial alternatives to address soil contamination at AREEs 2, 4, 28-5, and 31.

ALTERNATIVE 1: No Action; and
ALTERNATIVE 2: Soil Removal.

Based on available information, VHFS prefers Alternative 2 which includes excavation of contaminated soil and off-site disposal at a permitted facility. This remedial alternative is a permanent solution that offers long-term effectiveness since the contaminated soil is removed to cleanup levels and transported off site for proper disposal. Since the amount of soil requiring remediation is relatively small (approximately 400 cubic yards), it was not practical to consider active treatment or containment options in terms of cost-effectiveness and implementability. The excavation and disposal of contaminated soil would be done in accordance with federal and Commonwealth of Virginia solid and hazardous waste regulations.

FOR MORE INFORMATION

You can review the Proposed Plan and related technical documents at the information Repository at the following location:

Fauquier County Library, Warrenton Branch - Reference Section
11 Winchester Street, Warrenton, VA 22186
Hours: M-W: 10 a.m. - 9 p.m.
and Th-Sat 9 a.m. - 5 p.m. and Sun: 1 p.m. - 5 p.m.
Phone: (540) 347-8750

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